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Editor: GEORGE SELL

Vol. 8, No. 88 **April 1954**

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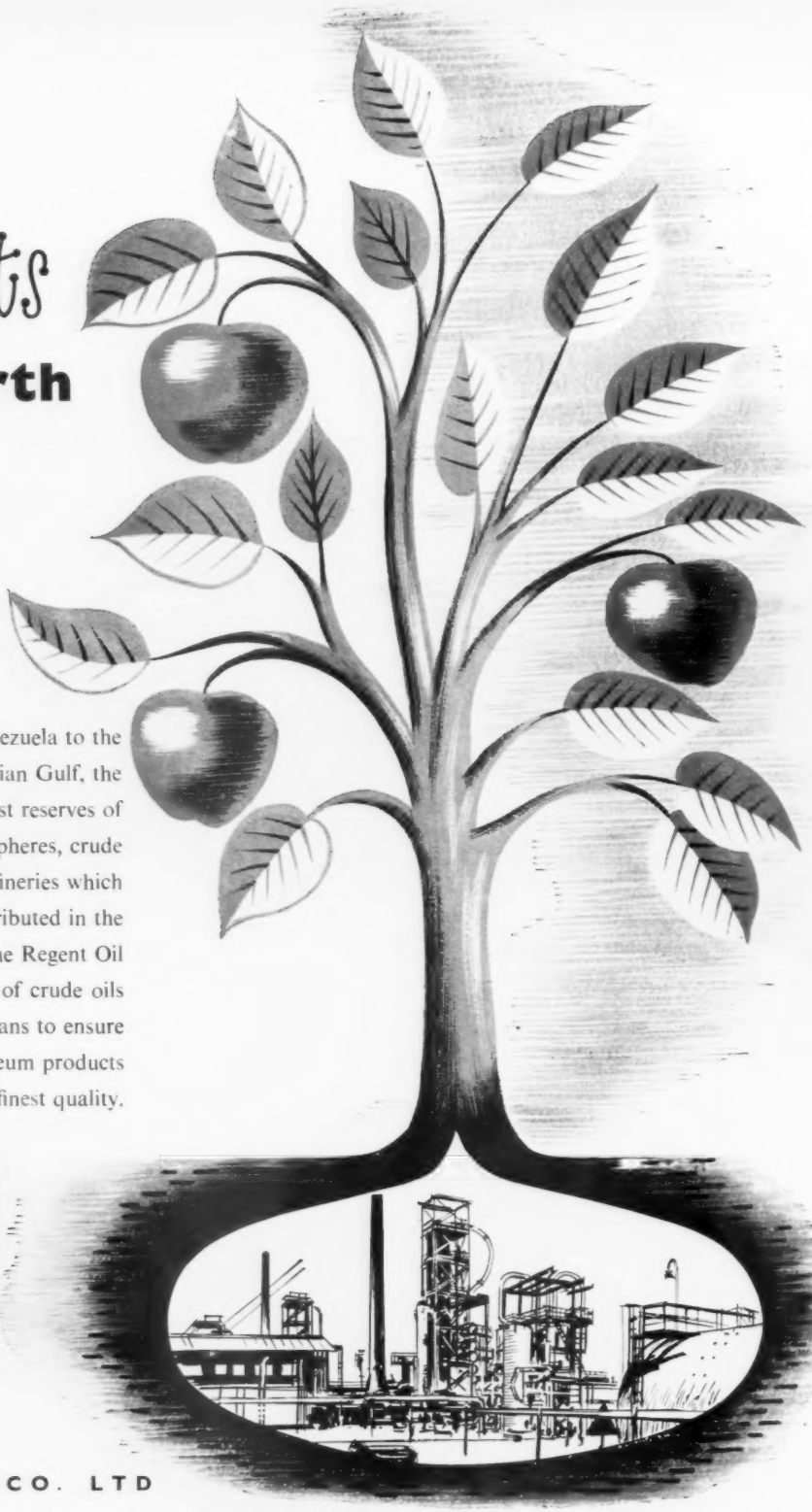

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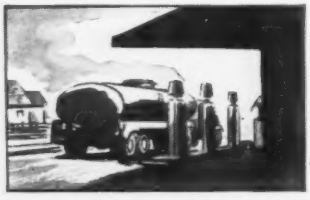

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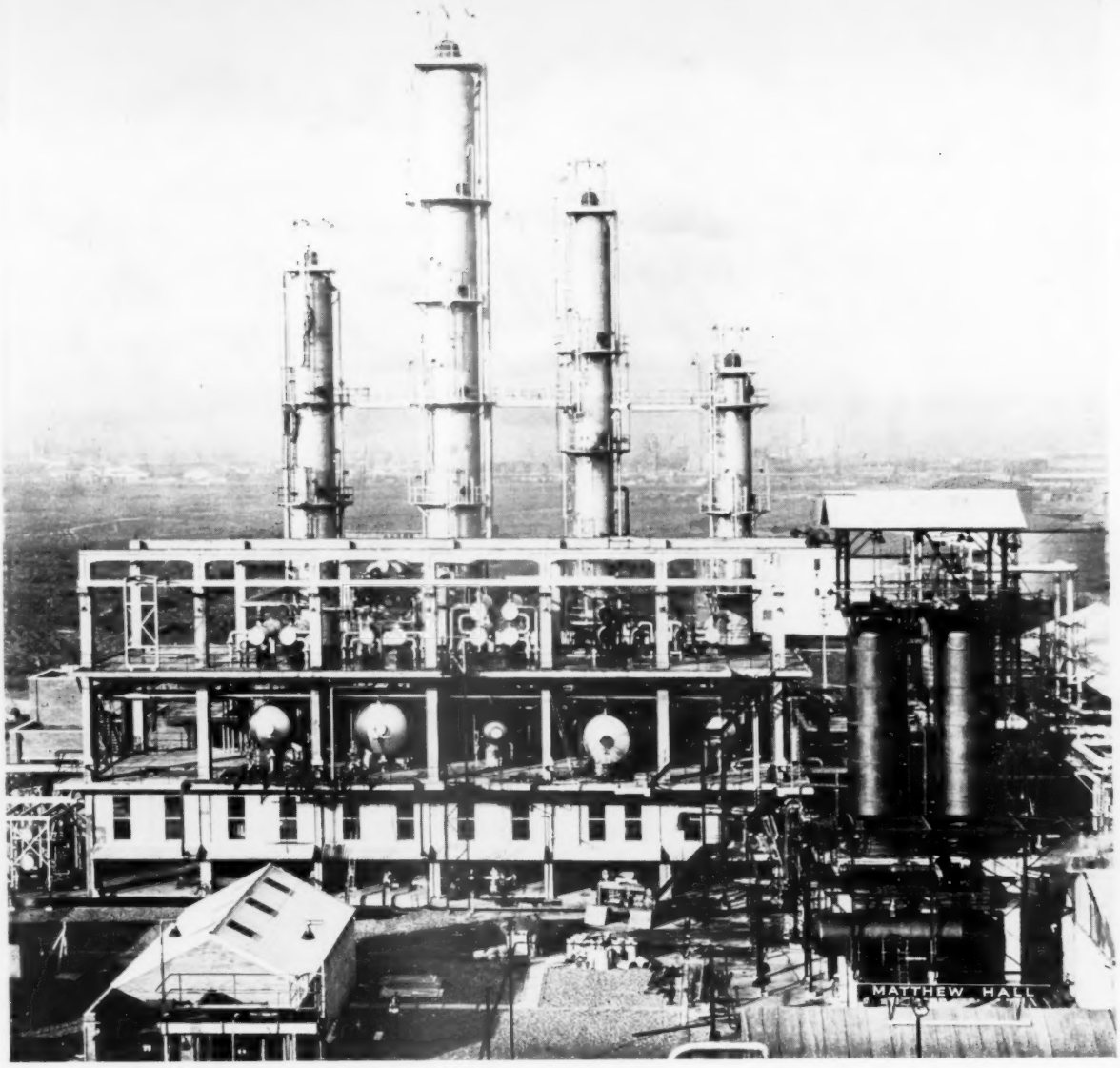

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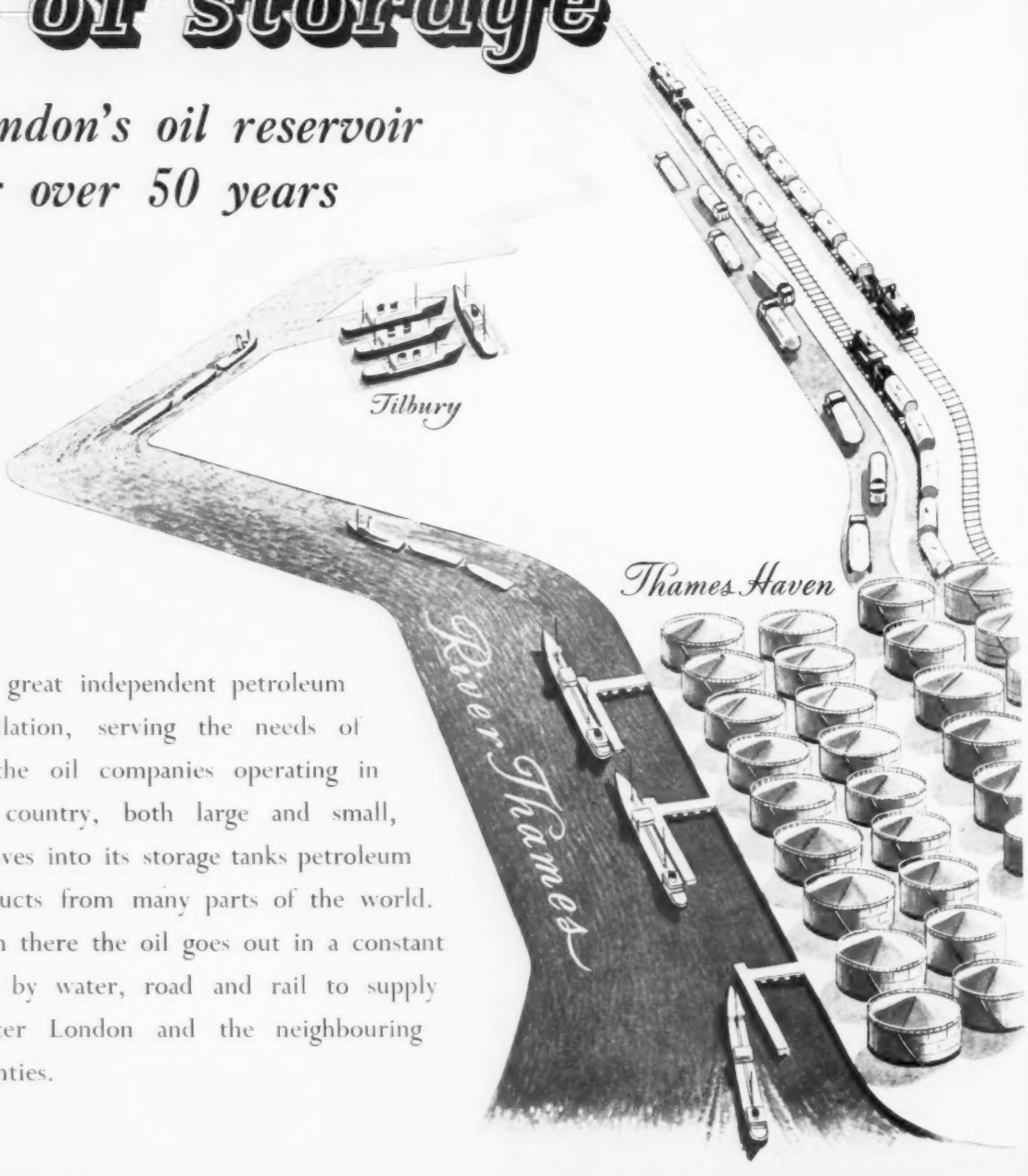

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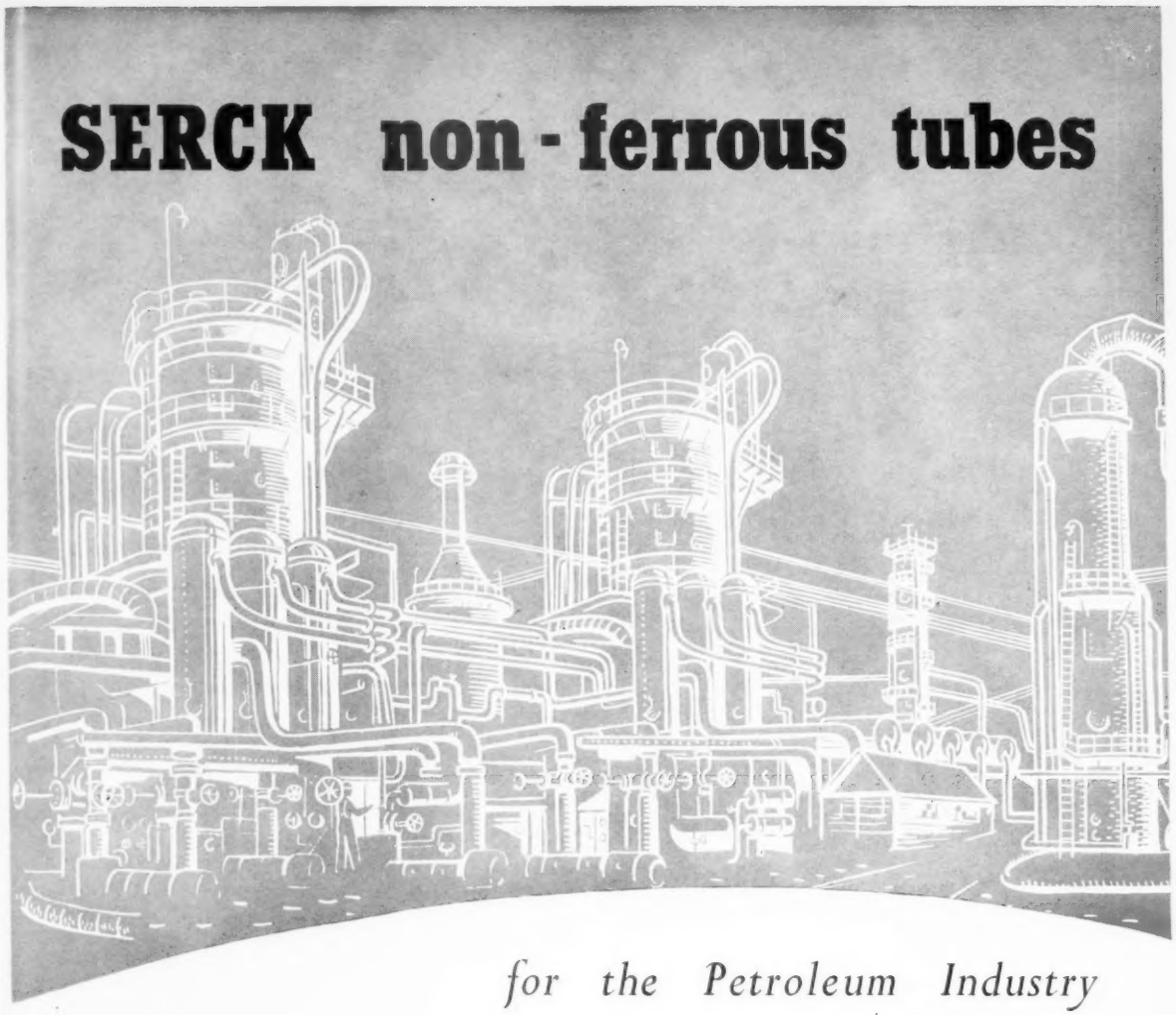

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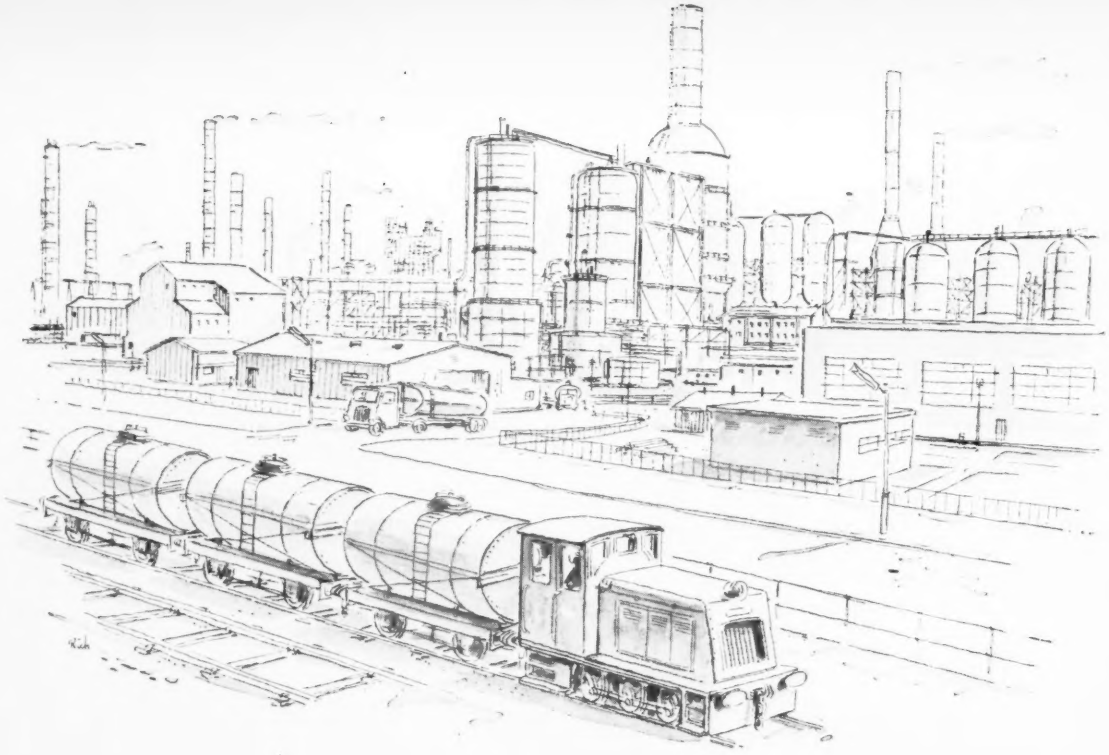

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At the Annual Dinner

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His Royal Highness The Duke of Gloucester and The President.

The guests at the 1954 *Annual Dinner, some of whom are seen here being greeted by the President, included* (left to right) *H.R.H. al-Amin Zeid ibn al-Hussein (the Iraqi Ambassador), H.E. Mons Faiz El-Khouri (the Syrian Ambassador), H.E. Mons Victor Khouri (the Lebanese Ambassador), H.E. Assayed Suleiman Nabulsi (the Jordan Ambassador), H.E. The Hon. Sir Thomas White (High Commissioner for Australia), and J. E. Coulson (Foreign Office).*

The 1954 Annual Dinner

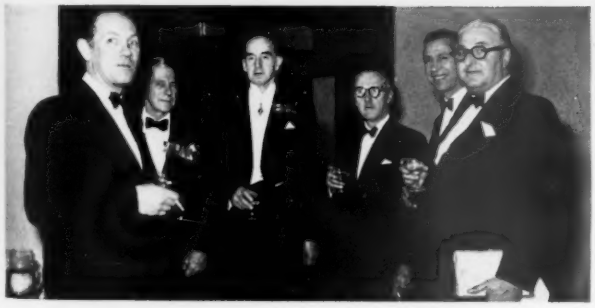
The Institute was greatly honoured by the gracious presence of His Royal Highness The Duke of Gloucester at the 1954 Annual Dinner.

This was held at Grosvenor House on 24 February, when nearly 1100 members and guests assembled under the chairmanship of Mr H. S. Gibson, C.B.E., President of the Institute. Among those present was His Excellency The Honourable Sir Thomas White, K.B.E., D.F.C., V.D., High Commissioner for Australia, who replied to the toast to *The Guests*.

The official guests included His Royal Highness al-Amir Zeid ibn al-Hussein, G.B.E., the Iraqi Ambassador; H. E. Monsieur Faiz El-Khouri, the Syrian Ambassador; H. E. Monsieur Victor Khoury, the Lebanese Ambassador; H. E. Assayed Suleiman Nabulsi, the Jordanian Ambassador; Major-General W. E. V. Abraham, C. B. E. (*Burmah Oil Co. Ltd.*); R. Allen, C.M.G. (*Foreign Office*); Monsieur M. J. Andrault (*Assoc. Française des Techniciens du Pétrole*); R. J. Ayres, C.B.E. (*Ministry of Fuel and Power*); Capt Bosville Macdonald (*Equerry-in-Waiting to the Duke of Gloucester*); V. S. Butler, C.M.G. (*Ministry of Fuel and Power*); Sir John D. Cockroft, Kt., C.B.E. (*Atomic Energy Research Establishment*); J. E. Coulson, C.M.G. (*Foreign Office*); Admiral ot the Fleet, Sir John Cunningham, G.C.B., M.V.O. (*Iraq Petroleum Co. Ltd.*); Dr A. Fleck (*I.C.I. Ltd.*); Sir Frederick Godber, Kt. (*Shell Petroleum Co. Ltd.*); J. C. Gridley, C.B.E. (*Vacuum Oil Co. Ltd*); C. H. Herridge (*Iraq Petroleum Co. Ltd.*); W. Howard-Williams (*Lobitos Oilfields Ltd.*); Dr W. Idris-Jones (*Institute of Fuel*); B. R. Jackson (*Anglo-Iranian Oil Co. Ltd.*); W. E. Jenkins, C.B.E. (*Esso Petroleum Co. Ltd.*); Air Marshal Sir John Whitworth Jones, K.C.B., C.B.E. (*Air Member for Supply and Organization*); J. B. Kay (*Ministry of Fuel and Power*); R. Kelf-Cohen, C.B. (*Ministry of Fuel and Power*); Prof W. B. R. King, O.B.E., M.C. (*Geological Society*); C. E. Loombe (*Bank of England*); G. F. Marsh, C.B. (*Admiralty*); Vice-Admiral (E) F. T. Mason, C.B., C.B.E. (*Engineer-in-Chief to the Fleet*); Sir W. G. Ogg, Kt. (*Society of Chemical Industry*); H. W. Page (*Standard Oil Company of New Jersey*); J. M. Pattinson, C.B.E. (*Anglo-Iranian Oil Co. Ltd.*); Prof J. A. S. Ritson, D.S.O., O.B.E., M.C. (*Institution of Mining and Metallurgy*); General Sir Ouvry Roberts, K.C.B., K.B.E., D.S.O. (*Quartermaster-General to the Forces*); S. Robson (*Institution of Chemical Engineers*); Major-General Sir Guy Salisbury-Jones, K.C.V.O., C.M.G., C.B.E., M.C. (*H.M. Marshal of the Diplomatic Corps*); R. E. F. de Trafford, O.B.E. (*Manchester Oil Refinery Ltd.*); C. M. Vignoles, O.B.E. (*Shell-Mex and B.P. Ltd.*); Dr O. H. Wansbrough-Jones, C.B., O.B.E. (*Ministry of Supply*); Sir Laurence Watkinson, K.B.E., C.B., M.C. (*Ministry of Fuel and Power*); D. Wilson (*Council of British Manufacturers of Petroleum Equipment*); P. H. St. John Wilson, C.B.E. (*Ministry of Labour*); R. Zuideveld (*Metal Containers Ltd.*).

Among the Members of Council present were: (*Past-Presidents*) Col S. J. M. Auld, O.B.E., M.C.; T. Dewhurst; Prof F. H. Garner, O.B.E.; E. A. Evans; C. A. P. Southwell, C.B.E., M.C. (*Vice-Presidents*) Dr E. B. Evans; H. E. F. Pracy; G. H. Thornley. (*Members*) W. S. Ault; S. A. Berridge; V. Biske; A. W. Deller, D.F.C.; E. J. Dunstan; F. L. Garton; A. J. Goodfellow; N. W. Grey; A. C. Hartley, C.B.E.; Prof F. Morton; J. S. Parker; D. L. Samuel; O. F. Thompson, O.B.E.; A. T. Wilford; Dr C. G. Williams.

The President was supported by many of his colleagues on the Council of the Institute, including (left to right) *Col S. J. M. Auld (past-president and president-elect), T. Dewhurst, C. A. P. Southwell, Prof F. H. Garner (past-presidents), Dr E. B. Evans and H. E. F. Pracy (vice-presidents).*



All dinner photographs by the Grosvenor House Photographic Service

The Annual Dinner provides an excellent opportunity for members to entertain their friends and to renew many old friendships. The photographs on this page illustrate many such meetings at the 1954 *function.*

The Industry and the Institute

H.R.H. The Duke of Gloucester, proposing the toast of "The Petroleum Industry and the Institute of Petroleum" said:

I welcome this opportunity of meeting so many representatives of a great industry, and of proposing the main toast at the Annual Dinner of your Institute.

The story of the oil industry is a romance. Our very civilization has been transformed by the oil which, extracted by your skill from many distant lands, you convert into the numerous petroleum products which we now take for granted in our everyday life.

We hear so much today of the coming wonders of atomic power that perhaps we tend to overlook the wonder of oil whose time is, incidentally, very far from being spent since, through the competence and energy of the industry, reserves today stand at a higher level than ever before.

Almost unknown 100 years ago, oil is now the largest single item in international trade in volume and value, and in the modern world it may rightly be termed the life-blood of industry, agriculture, and transport.

Your industry is remarkable in many ways. It is in a true sense international, for your trade is carried on throughout the world, and promotes commerce between nations. It promotes, too, the material well-being of nations, not only those to whom oil is supplied, but also the countries under whose soil it is found. Countries where oil is produced benefit both from royalties they receive and also from the activities of the companies operating there, who, with justification, pride themselves on being model employers.

Since 1939 the demand for oil has doubled and this astonishing fact has brought great changes in its train. The very pattern of trade has changed. New sources of supply have been found and in particular the oilfields of the Middle East have been expanded at a fabulous rate; and, whereas before the war a very large part of Europe's requirements of oil came from the Western Hemisphere, now the bulk comes from the Middle East. Crude oil has, of course, to be refined before it can be used, and immense sums of money have been spent on the erection of new refineries and on expanding existing installations. Here again, however, there has been a great change. For reasons appealing both to the oil companies and governments, the new refineries have been built not where the crude oil is produced, as in pre-war years, but in or near the areas where the products are marketed. So we have seen in this country the development of oil refining into a great new industry; throughput has increased from about 3 million tons a year before the war to about 25 million tons in 1953.

We are, however, interested in a great deal more than the United Kingdom position. The British and British-Dutch oil companies' trade is world-wide, and with their chain of refineries spread over the entire globe, they earn us much foreign currency. American oil companies, of course, market oil in this country and in the rest of the Commonwealth, and this does cost us foreign currency, but a tribute is due to our American friends who have made strenuous and successful efforts to arrange their trade in the sterling area in a manner which assists us in our currency problems.

To carry the increased quantities of oil more and larger tankers have been constructed and much of the capacity of our shipyards is devoted to this work. I must mention too, the British oil equipment industry which now makes a substantial part of the equipment needed by the companies for their home and overseas operations. This comparatively new industry is saving us dollars and, by selling overseas, earns foreign currency as well.

All these changes and developments required vision, skill, and resolution to bring about. It must indeed be a great satisfaction to the industry to have so successfully met and surmounted the difficulties involved, and in the process to have brought so much benefit to the free world.

An industry of this size and complexity calls for the application of a great many techniques and sciences. It was to bring together the men and their ideas, that the Institute of Petroleum was first founded over 40 years ago. Since then the Institute has grown with the oil industry and has extended its scope. Through its many branch organizations, by encouraging research and by disseminating information, it has played no small part in furthering the progress of the industry.

The oil industry is dynamic and enterprising. Progress is its watchword, and it has never yet been found wanting. So it is with great pleasure that I propose the continuing prosperity of the industry and of the Institute of Petroleum, coupled with the name of its President, Mr Gibson.

Oliver F. Thompson, a Member of Council of the Institute, exchanges greetings with C. M. Vignoles, managing director of Shell-Mex and B.P. Ltd.

The President's Reply

Mr H. S. Gibson, C.B.E., replying to His Royal Highness, The Duke of Gloucester, said:

It is my privilege, on behalf of the industry and the Institute, to thank His Royal Highness for having so graciously proposed the toast of the petroleum industry and the Institute of Petroleum, and to say how greatly we are honoured by his speech to us tonight.

I well remember the visit of His Royal Highness to the Middle East during the war, and the interest which he showed in our industry at that time. His presence here tonight, in happier times, is indeed a stimulus to all of us.

His Royal Highness has spoken in very generous terms of the contribution which petroleum has made to industrial development and of its service to mankind. He has emphasized the international character of the petroleum industry which depends on the co-operation of the peoples and governments of so many lands.

It is interesting to note that during the last 60 years world consumption has doubled approximately every 12 years; last year it amounted to 650 million tons.

There are three reasons I think for this great expansion in the consumption of petroleum. First, there is the adaptability of the oil industry, and by adaptability I mean the meeting of changing demands and conditions. Secondly, there is the industry's development of the technique of large-scale operation in trans-

Many of the leading figures in the British oil industry were present at the dinner and are seen here being welcomed by the President. (Left to right): *Admiral of the Fleet Sir John Cunningham, Sir Frederick Godber, Howard W. Page, J. C. Gridley, and G. H. Herridge.*

portation and refining. Thirdly, the enthusiasm of oil men themselves.

Permit me to enlarge upon this quality of adaptability. Sixty years ago, the main marketing products of the oil industry were lubricants and lamp oil. Then came the internal combustion engine with its demand for light spirit, followed closely by the use of fuel oil for firing marine boilers. Soon a very important change took place, instead of engines being designed for fuels, fuels began to be designed for engines. Petroleum products were therefore required in greater variety and specifications became more precise, not only for fuels, but also for lubricants.

All these changes demanded great adaptability or flexibility, and the industry has met that need.

Now the petroleum industry has joined hands with the chemical industry and new fields for development are being opened. In this direction there are already indications that petroleum may have further contributions to make to improvement of agricultural production, which has already benefited by the better cultivation resulting from the mechanization of agriculture.

An example of what has already been achieved by petroleum chemicals was the destruction of a large swarm of locusts which in 1952 entered Iraq and settled in a cultivated area near the River Tigris. Action was at once taken to destroy them and this was accomplished in two days, using a modern petroleum-derived insecticide. The cost of carrying out this work was a quarter of a million pounds, but this was only 1 per cent of the estimated value of the crops saved. The increased production of food and the prevention of its loss both by the use of selective weed-killers and insecticides may well prove to be petroleum's greatest service to mankind.

Turning to my second point—large scale operation. In the last 40 years the cost of crude oil, process plants, labour, etc., has risen by 300 to 400 per cent, and yet the price of a gallon of ordinary petrol today, without duty, is 1s 8d compared with 1s 6d in January 1914. It is really remarkable that in spite of the great decrease in the purchasing power of money, the price of such an important commodity as petrol should have changed so little in 40 years. This is entirely due to the economies achieved by large scale operation in transportation and refining, and, I suggest, reflects great credit on the industry.

My third point is, to my mind, the most important of all. The enthusiasm of oil men is proverbial, but more than that, they are super-optimists. My wife, who has met a good many, says they do not have blood in their veins: they have crude oil. They are always prepared to go and look for oil in places where it has been declared impossible for it to exist, and, in the end, often find it there.

For its size the number of people engaged in the oil industry is small, the fraternity of oil men is world wide. They visit each other a good deal and always proudly show their latest equipment to their competitors, but keep quiet about the twenty-year-old plant around the corner. But with all this camaraderie there is intense competition which has played a most important part in the expansion of the industry.

The chemical industry does not yet know much about its new partner but is rapidly learning of its enthusiasm. When I recently visited a works where petroleum chemicals are produced, I was proudly shown a bottle of ethyl alcohol and assured that it was potable. I knew at once who the dominant partner was there.

In some industries fathers persuade their sons to follow other professions but it is another indication of the enthusiasm in the oil industry that I have never yet met a father in it who has not done his best to persuade his son to follow in his footsteps.

Among the official guests were (left to right)*: Sir Laurence Watkinson, Mons M. J. Andrault, P. H. St. John Wilson, and G. F. Marsh.*

Prior to 1939 the Institute devoted a portion of its funds to sponsoring research in university laboratories, and members of the Institute helped in this work through its research committee. Since the war, the Institute's funds have been inadequate to continue this work, but the Institute has continued to assist and guide two independently sponsored research groups. The first of these, the Hydrocarbon Research Group, is perhaps unique in the U.K., in that a number of member companies (eight in all) each contribute £1000 per annum, to a fund which is used by the group to sponsor research work at a number of universities into problems of hydrocarbon chemistry, spectroscopic and mass spectrometric methods of analysis. The second research group has been concerned with the biological activity of petroleum fractions and has worked in close collaboration with the Medical Research Council and the White Oils Committee.

The Engineering Committee of the Institute has devoted considerable attention during the year to the preparation of model codes of safe practice in the petroleum industry. Two codes have been drawn up, one on refining and the other on marketing, and these will shortly be published.

A safety sub-committee has been formed to provide an opportunity for safety officers of oil companies to meet and exchange views.

All the branches of the Institute continued to operate actively during the year, and a new one has just been formed in Australia.

This makes the third branch overseas, the other two being Trinidad and the Persian Gulf.

In concluding my remarks on the activities of the Institute I would like to thank all the members of the Council and all who have served on the various committees, for having devoted so much of their time to the Institute's affairs. A tremendous amount of work is done, and done so unobtrusively that one is hardly aware of it.

It is the President's prerogative on the occasion of this Annual Dinner to refer briefly to the major activities of the Institute during the past year.

The Institute, like the industry with which it is associated, is international in character. From its foundation in 1913 as the Institution of Petroleum Technologists, membership has been open to all nationalities, and in the first list of 146 members published in 1914, there were representatives of the U.S.A., Germany, Austria, Hungary, and Russia.

Today, the corporate membership still increases steadily, and is now just over 3100, in which no less than 34 different nationalities are represented. We also have 183 member companies whose continued support is of the utmost value to the Institute.

The Institute published several volumes during the year, the most important being the metric edition of the ASTM/IP Petroleum Measurement Tables in October, thus completing the set of three volumes, the other two being, of course, the American and British tables. The three volumes are a monument to international co-operation, for they are the result of six years' work by a team consisting of members from the ASTM and the Institute. The tables are now in world-wide use as a basis for standardized calculations of measured quantities of petroleum.

In November, the 13th edition of "Standard Methods for Testing Petroleum and its Products" and the 13th edition of "Reviews of Petroleum Technology" were published.

I cannot leave the subject of publications without saying that their success is due in large degree to our editor, George Sell, who has now been a member of the Institute for 34 years, and editor for 17.

"The Guests"

I now come to my most pleasant duty this evening, to propose the health of our guests. We are greatly honoured by the presence of His Royal Highness The Duke of Gloucester, His Royal Highness The Iraqi Ambassador, and Their Excellencies The Syrian, Lebanese, and Jordanian Ambassadors.

May I, on behalf of the Institute, extend a special welcome to His Excellency, Sir Thomas White, High Commissioner for Australia, in whose country the youngest branch of the Institute has been formed. This is a product of the rapidly expanding refinery programme which, by next year, will raise refinery capacity from the present level of one million tons to over six million tons per annum. This programme, costing £80,000,000, represents over a quarter of the total current industrial investment in Australia. This year also, the long and costly search for oil in Australia has met with success by the discovery of oil in Western Australia. Although this discovery may leave much to be desired, both in regard to quantity and quality, it is very important, because it proves that there is petroleum in Australia, and members will join with me in hoping that this may be the forerunner of still greater success.

We are glad to welcome too, the distinguished representatives of the Foreign Office, the Services, the Ministries of Labour, Supply, and Fuel and Power, with whom the Institute and the industry have worked in such close harmony.

It gives us very great pleasure to have with us tonight the President of the Association Française des Techniciens du Pétrole.

We salute, also, the representatives of the learned societies, many of which have contributed to the science of petroleum and from whose ranks the membership of the Institute and the personnel of the industry have been enriched.

We also have as our guests, representatives of the member-companies of the Institute, without whose generous help and co-operation the functions of the Institute would be seriously curtailed. These companies have supported the Institute not only through the contributions of their personnel to its proceedings, but by financial support for its research and educational programmes, and the international activities of the Institute.

His Excellency The Hon. Sir Thomas White, K.B.E., D.F.C., V.D., High Commissioner for Australia, responding on behalf of the guests, said they were particularly fortunate in having His Royal Highness The Duke of Gloucester with them. During his first visit to Australia in 1934, and later as Governor-General, the Duke had endeared himself to all Australians. Present also were His Royal Highness the Ambassador for Iraq, whom so many know as the brother of King Feisal and who had played such a stirring part in war and peace in the building up of that great country, and Their Excellencies the Ambassador for Syria, the Ambassador for the Lebanon, and the Jordan Ambassador. Britain had always been a traditional friend of these countries and still is.

It seemed difficult to imagine a world without oil, yet the oil industry, as the Duke said, was not 100 years old, though it seemed to have been known to the ancients. It might not be an exaggeration to say that bitumen was used on the Ark. It was not known what illumination Noah used on the Ark, but he may have used bitumen on the hull. The 1915 campaign in Mesopotamia, incidentally, was promoted to protect the oil wells in Persia—it carried out that protection better in 1915

than happened in recent years. It was an Australian, as many of them knew, who discovered and developed the oil in Persia—William D'Arcy.

Continuing, Sir Thomas White said that among the other distinguished people present were the Government and Services representatives, and also the taxers and the taxed. The President had said that petrol cost 1s 6d in 1914, and 1s 8d in 1954 excluding taxes, and that showed that the tax boys knew their job. But services and the welfare state must be paid for. In Australia, but for the petrol tax, there would be no good roads. The next group of distinguished guests were the presidents of societies and institutions, the scientists, the boffins, and the member companies.

Concluding, Sir Thomas said that all the guests realized the international value of the Institute. They knew that the advance in economy and progress was in the hands of the members. The skilled membership of the Institute, its international outlook, and its progressive policy could achieve much more, because in a history of only 100 years there was much more to be done. Speaking on behalf of all the guests present he congratulated the Institute on all that it had achieved so far and what it had contributed towards the development and enrichment of the world.

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PETROLEUM IN PARLIAMENT

Oil Pollution

The Minister of Transport and Civil Aviation was asked on 29 January whether he would take steps to stimulate the development of efficient separating apparatus for use in ships and harbours.

In reply, the Minister said that the Faulkner Committee had carried out tests on various makes of oily water separators, of which considerable numbers are now fitted in ships, and had also tested methods of disposal and treatment of oily residue ashore. The Committee had concluded that the majority of separators on the market in this country could be relied upon to give satisfactory performance, although there was scope for improvement. The Minister also said that he was considering the desirability of drawing up a performance specification for the guidance of manufacturers and ship-owners.

Further reference was made to oil pollution on 10 February when the Minister was asked whether he would take steps to appoint a day after which no tanker or ship burning oil would be allowed into any United Kingdom port unless equipped with an oil separator and sludge tank.

Mr Lennox-Boyd said in reply that the Report of the Committee on the Prevention of Pollution of the Sea by Oil had showed that oily-water separators were not required in tankers and had recommended that this apparatus should be fitted only in those United Kingdom registered dry-cargo ships which use tanks alternately for oil fuel and water ballast. Legislation would be required, said the Minister, to give effect to this recommendation and others made by the Committee, but this would be introduced as soon as possible after the international conference on oil pollution which is to take place next April.

FIDO

Answering a question on 4 February with regard to the progress of FIDO at London Airport, the Minister of Transport and Civil Aviation said that development work had now reached a stage where, from the engineering aspect, no major difficulties in the construction of a full-scale installation were expected. The Minister also said, however, that experience in the U.S.A. with the only full-scale high pressure FIDO system in existence had thrown considerable doubt on the efficiency of the system developed there as an acceptable aid to civil aviation. American results were, therefore, being closely watched and, meanwhile, the costs and methods of financing a possible installation at London Airport were being re-examined.

Residual Fuel Oil

The Minister of Fuel and Power was asked on 22 February what progress had been made in producing gas from residual fuel oil and how the cost of producing one therm compared with the cost of one therm produced by orthodox methods.

In reply, the Minister stated that two experimental plants were in operation and two more would be ready in a few months. Results so far were promising but comparative costs could not yet be determined.

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NEW TANKER "REGENT ROYAL"

A new tanker, *Regent Royal*, was launched on 18 January at Scotstoun on the Clyde by Her Royal Highness the Princess Royal.

The new vessel, a motor tanker of approximately 15,000 dw tons, has been built by the Blythswood Shipbuilding Company Ltd, for Trinidad Leaseholds Ltd. The tanker will carry a cargo of approximately 13,500 dw tons on a draught of about 28 ft 3 in. She has an overall length of 514 ft, a breadth of 65 ft 6 in, and a moulded depth of 35 ft 4 in.

The *Regent Royal* has 24 main cargo oil tanks, arranged in eight sets of three abreast. These are divided into three separate sections by two large pump rooms.

After the launching ceremony, a luncheon was held at which Mr Hugh M. Macmillan, chairman, managing director, and founder of the Blythswood Company, proposed the health of the Princess Royal and presented her with a diamond brooch on behalf of the shipbuilders and owners.

Special care has been taken to provide first-class accommodation and arrangements for officers and crew. One feature of the

ship is a sun deck with built-in swimming pool for the use of the ship's personnel and members of the Trinidad Leaseholds staff and families who may be travelling between Trinidad and the United Kingdom.

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DIESOLITE

Diesel tractor fuel produced by Shell-Mex and B.P. Ltd. is to be known in future under the name Diesolite.

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ABCM

New address of the Association of British Chemical Manufacturers is Cecil Chambers, 86 Strand, London, W.C.2, the telephone number being COVent Garden 2363.

The Distribution and Industrial Uses of Fuel Oil in the U.K.*

By T. D. AMBROSE

The total consumption of petroleum products in the U.K. in 1951—excluding fuel oil for bunkers—was 16·9 million tons, of which just over 6 million tons (or 35·5 per cent) was fuel oil. The term "fuel oil" includes gas oil, diesel oil, and residual fuels but not diesel fuel used for road transport. If the fuel oil consumption in the refineries is excluded, the country is left with an inland requirement of about 5¼ million tons which compares with approximately 1·3 million in 1938. This 5¼ million tons is a little over 3 per cent of the world fuel oil consumption, and is practically all used for industrial or agricultural purposes. Since about 206 million tons of coal were used in the U.K. in 1951, the fuel oil represents some 4 per cent of its total heat requirements.

In a coal-producing country, solid fuel and its derivatives should always receive sympathetic consideration in any heating problem and, in general, fuel oil should be used in preference to solid fuel only where it confers economic or technical advantages. The era of cheap labour and abundant supplies of coal is over, and industrial requirements are continually becoming more exacting. The constant endeavour to improve quality and decrease production costs has resulted in a demand for a source of consistent, clean, and controllable high-grade heat at a reasonable cost per therm. To a great and increasing extent fuel oil has met this demand and, in consequence, has become of very considerable importance to the industrial life of the U.K.

Distribution

Each working day consumption of fuel oil in the U.K. is about 20,000 tons and the efficient distribution of this is a most important part of the marketing operation. Although considerable quantities are handled by rail cars or waterborne vessels, the majority is carried by road vehicles. The delivery service has to cater for the reasonable, and occasionally the unreasonable, demands of consumers and yet be economic.

When the oil distributing companies began operations over 40 years ago they were chiefly concerned with kerosine. Later on the sales of motor spirit began to assume importance, but since all deliveries were made by horse-drawn vehicles with a small radius of operation a very large number of depots was necessary. Kerosine was delivered from a tank carried on the vehicle, and spirit in two-gallon cans, usually sold through a retailer.

In contrast to this the use of fuel oils in considerable quantities is a relatively recent development, and from the start the oil company has been in direct contact with the user. It has thus been possible to enlist the co-operation of the consumer in providing storage to take reasonable bulk deliveries, and further, to ensure a reserve stock is in hand at the buyer's premises, say for ten days or more, when further supplies are ordered. This does not only remove any cause for anxiety regarding the actual time of delivery, but it ensures that full economic loads can be carried and enables maximum use to be made of the road vehicles by careful routeing. The same considerations apply to some extent if delivery is by alternative methods. The development of the fuel oil trade along these lines and the increased use of the motor vehicle has resulted in a much greater radius of operation from distributing centres, compared with the old horse-drawn waggon days.

Relatively few fuel oil distributing installations were necessary for the trade in 200-sec fuel, gas, and diesel oils, which were the main products before the second world war. In any case, the main fuel oil consuming zones are the industrial areas of the country which are fairly well-defined.

This state of affairs was satisfactory until the present considerable trade in heavy fuel developed. This fuel has to be warm in order to pump it, so coiled tanks and adequate steaming capacity became necessary at main distribution installations. Such facilities did not exist at the normal depot since they were not required for the other products handled. However, it has been found economically possible to send out a very large proportion of this heavy fuel oil direct from the distribution centres adjacent to the refineries, from which deliveries are made over wide areas. Where it is not possible to cater for the requirements of a large industrial zone direct from the refinery then secondary main installations are necessary, and these are fed by the most economic means from the producing centre. It must be borne in mind that the normal heavy fuel oil user consumes substantial quantities and can receive warm fuel delivered in full road vehicles over considerable distances, or can receive coiled rail cars which can be heated and discharged by the user.

It is here interesting to note that the relative costs of road and rail transport over the past 25 years have shown an increasing disparity in favour of the former method.

Apart from the main industrial areas, there is a valuable market for distillate and 200-sec fuel, which cannot be economically supplied from a main or secondary centre direct. These smaller consuming zones are catered for by using rail heads where rail cars are emptied direct into road vehicles. This arrangement, however, is not possible for heavy fuel. Finally there is the trade in barrelled distillate fuel oil, and although barrelling is costly certain users must receive their supplies by this means.

This is a very incomplete account of the system used to supply the country with fuel oils, especially as each major company adopts methods to suit its own main distribution centres. Thus the marketing of fuel oils has been streamlined by reducing the number of distribution centres and delivering the largest possible loads.

As soon as delivery arrangements are settled, the marketing company's interest turns to the oil handling facilities at the user's premises, and it is part of the service of the supplier to make detailed recommendations for the storage and handling plant to cater satisfactorily for the needs of the consumer. Once this has been achieved the help of the representative of the oil company is freely available for suggesting possible improvements in combustion technique or process efficiency. The transport, handling, and combustion of the oil are all three essential parts of efficient marketing technique, and the oil company is concerned in each case.

Uses of Fuel Oil

Now consider how this quantity of five and a quarter million tons of liquid fuel is used each year in the U.K.

*Paper presented to the South Wales Branch 9 April 1953, and published by courtesy of the directors of Shell-Mex and B.P. Ltd.

Boilers

About a million tons is used for steam raising for process work and other purposes. Central heating of factories, offices, and other premises consumes nearly a further half million tons. There are many reasons why such a considerable amount is used for these purposes, but greater cleanliness and saving in labour are two potent factors in favour of fuel oil as compared with solid fuel. Ease of delivery and distribution, and economy in storage space are other important considerations, and these combined with flexibility of oil firing and the virtual absence of solid matter in the flue gases contribute to the convenience of liquid fuel. These factors are of considerable importance, and food, paper, and vitreous and paint enamelling are examples of widely differing industries where the use of fuel oil for boiler firing has been adopted for sound commercial reasons.

Steel Manufacture

The importance to the U.K. of the steel making industry cannot be overstated, and of late years great efforts have been made to increase output. The use of oil has developed rapidly in the past ten years or so, and at the present time the annual consumption exceeds one million tons. About three quarters of this amount is used in firing open-hearth steel furnaces, although considerable quantities are also consumed by other types of equipment, such as soaking pits, reheating furnaces, and furnaces used in the steel fabricating trades.

In the open-hearth furnace full advantage can be taken of the high temperature and radiating power of a fuel oil flame, and this has resulted in an increase in output of about 10 per cent over similar producer-gas-fired furnaces. Open-hearth furnaces in the U.K. are up to 250 tons in capacity and are charged with either molten or cold iron and scrap steel; the process consists of refining the metal by removing sulphur, silicon, phosphorus, and carbon by oxidation into the slag. The nature of the charge and duration of refining time will considerably affect the fuel consumption, but a furnace of 100 tons capacity charged with 60 tons of hot iron and 40 tons of cold scrap steel requires about 12 tons of fuel oil per melt.

Steel Fabrication

Increasing amounts of fuel oil are being used in the steel fabricating industry, and one process in which oil is by far the most important fuel in use is drop forging. In this process, open-fired furnaces are used to heat steel billets or bars until they become plastic. Care is taken to avoid overheating and burning and to keep scale to a minimum, and many furnaces have automatic temperature controls.

The actual stamping is carried out by using a drop hammer, consisting essentially of a heavy weight (the Tup) containing the top half of the die which is allowed to fall on the lower anvil block containing the bottom half of the die. The compressing of the hot plastic steel between the two dies constitutes the actual drop forging operation and induces the metal to flow into the cavities in the dies. Great care is taken to obtain correct grain flow in the metal in the finished forging, which is very much stronger than a similar casting would be.

It is necessary to heat treat many drop forgings, and fuel oil is often used to fire such furnaces. A temperature of about 900°C is normal, and a modern, continuous, well insulated, and correctly loaded heat treatment furnace will attain a 50 per cent efficiency. Many other types of furnaces used for steel fabricating, such as plate heating, rolling mill billet heating, and pin heating (for bolts and nuts), are commonly oil fired.

Metal Protection

Without some form of coating, iron and steel will corrode. Vitreous enamelling, galvanizing, and stove enamelling are three methods of protecting the metal in which oil firing is used.

Stove Enamelling. In stove enamelling the articles are coated with varnish paint and carried through an oven which is kept at about 450°F, often by means of an air heater. After about a quarter of an hour's exposure to air at this temperature the coating has set hard.

Galvanizing. When clean iron or steel is immersed in molten zinc a coating is rapidly formed which consists of an inner portion of iron zinc alloy and an outer coating of zinc. This process is known as galvanizing and a bath temperature of about 455°C is maintained. Accurate controls for keeping the temperature of the spelter constant are essential, and the rate of heat input can be governed by a thermo-couple immersed in the metal.

Vitreous Enamelling. This consists of applying a coating of special powdered glass, known as frit, and heat treatment at about 900°C when the covering material fuses into a strong protective outer layer.

In this industry there are three different applications of oil firing. First, there is the actual enamel or frit making furnace, in which frit is made by melting soda ash, sand, potash, and borax as well as other ingredients; this is an open flame reverberatory furnace. One gallon of oil will melt about 40 lb of frit. The coefficient of expansion of the resulting coat must be suitable for the article to be treated. Oxides are used for colouring the enamel.

The frit is powdered and normally mixed with water and other ingredients to retard settling. This creamy mixture is then applied by means of a spray gun or by dipping. The coated articles are then dried and at this stage the powdered glass coating can be rubbed off the metal surface. This is the second application of oil firing, where oil is used to provide hot air for the drying oven.

The final operation consists in bringing the dry coated ware up to the correct temperature at the correct rate so that the particles of frit fuse and form a hard protective vitreous coating which combines with and adheres to the surface of the metal. Several coats may be necessary. This is always done in a full muffle furnace where the atmosphere of the fusing chamber is not contaminated with the products of combustion. Such furnaces can be batch or continuous but naturally the latter type is more efficient. In a continuous furnace the articles to be enamelled are taken through the muffle by hanging them from a chain conveyor travelling above the centre of the furnace roof. Rods from this conveyor pass through a continuous slot. About 2000 sq. ft. of enamelled steel sheet per hour can be produced in a furnace of this type for a consumption of about 25 gallons of oil. The carrying furniture has to be heated, but the gross heat efficiency is usually around 35 per cent. The heating is automatically controlled.

Glass Manufacture

The glass industry uses considerable tonnages of oil fuel.

Common glass for bottles etc. is made from clean sand, soda ash, limestone, and small quantities of other ingredients. These are mixed and, to assist melting, broken glass or cullet is added. The mixture is fed continuously into a furnace, known as a tank, which may contain one hundred tons or more and is essentially a rectangular box of high grade refractory material. Flames from the burners radiate over the surface of the melting glass which is brought to a temperature of about 1400°C. To conserve heat and increase the flame temperature practically all the air used is highly preheated, usually by regenerators. A hundred-ton oil-fired glass tank will supply about 25 tons of glass per day to automatic bottle-making machines on a consumption of about 7 tons of oil per day, with a heat efficiency of approximately 15 per cent.

The well-known heat-resisting glass is also made in a tank, but since it has a higher silica content the working temperature is considerably higher than the bottle-glass tank, and is over 1500°C. Reference should also be made to the manufacture of cut glass, a mixture of white silica sand with about 35 per cent lead oxide, and potash. This glass has a high refractive index.

It is melted in pots, which are hooded to protect the contents from the products of combustion, and the glass is gathered from the pots and blown to the required shape before annealing, cooling, and subsequent cutting with abrasive wheels.

Ceramic Industry

The ceramic industry is another very important application of fuel oil. Oil is often used for firing tunnel kilns, which are commonly used in the manufacture of glazed tiles, crockery, and enamelled sanitary ware. The tunnel kiln consists of three parts: the preheating, firing, and cooling zones. The articles to be heated are loaded on to trucks which pass through in a continuous feed. The ware is protected from the flue gases by using a full muffle, or packing it in refractory boxes called saggers if the kiln is open fired. Two heatings are necessary, the first known as the biscuit firing is necessary to set the moulded article, and the second which is used to fix the glaze is called the glost firing.

In the manufacture of 6 × 6 × ⅜ inch glazed tiles, which consist essentially of clay and silica, the tiles are biscuit fired to about 1170°C, an operation which takes three days. A special glaze made from borax, lead oxide, and silica sand is then sprayed on after the first firing and the tiles are glost-fired to about 1080°C. This second firing takes about two days. The tiles are stacked on trucks and a furnace taking about two tons of tiles per hour for biscuit firing would use about 50 gal of oil.

Non-Ferrous Metal Fabrication

The use of fuel oil in the non-ferrous industry has become commonplace. For melting large quantities, reverberatory furnaces or rotary melters are used, but crucible or pot furnaces are common, especially in works where a number of alloys are needed.

Copper refining furnaces which may be over one hundred tons capacity need a temperature of about 1200°C, and consume just over 20 gal of oil per ton. Aluminium alloy melting furnaces holding 15 tons or more are common and for straight melting a temperature of about 750°C is needed, for which the oil consumption would be under 20 gal per ton. Oxidation losses must be kept low, and this is achieved by speed of melting and atmosphere control.

Crucible furnaces are used to melt up to 15 cwt at a time, and although oxidation and contamination are reduced, the fuel cost is greater. A 450-lb crucible furnace will melt a charge of brass in about 45 minutes using about 4½ gal of oil.

Many metal alloys are now extruded to rods of various sections or tubes. The metal in the form of a billet is heated until it is plastic, and is then inserted in a powerful press which extrudes the metal through an orifice of the desired section in a die. Billets of copper are heated to about 900°C, and about 7 gal of oil per ton would be a reasonable consumption on a correctly operating semi-muffle type of furnace. About 50 per cent heat efficiency is obtained on a well-designed continuous billet heating furnace working at about 900°C, providing the furnace is well insulated and adequately loaded.

Baking

An important application of fuel oil is for heating ovens used in baking bread, biscuits, and confectionery. In a modern bakery, sacks of flour, each containing 280 lb, are mixed with 3 lb of yeast, 10 lb of salt, and 15 gal of water to each sack. The resulting dough is left to rise, and is then fed to automatic machines which divide it into 2 lb pieces. After further working of the yeast, it is shaped and put into tins, and allowed to rise by warming to about 100°F for about three-quarters of an hour. This is known in the trade as proving. It is then ready for baking and this operation takes about three-quarters of an hour, and a temperature of about 550°F is needed. The dough made from one sack of flour will produce about 220 loaves of bread each weighing 1 lb 12 ozs. There are many types of oven, both batch and continuous, but the oil consumption of a modern travelling continuous bread oven, producing many hundreds of loaves per hour, is about 1¼ gal per sack of flour.

Carburetting Water Gas

In periods of peak consumption the gas industry uses gas oil for the manufacture of carburetted water gas, and about half a million tons annually is consumed in this process. A mixture of hydrogen and carbon monoxide, known as water gas, is produced by the action of steam on incandescent coal or coke. This has a calorific value of about 300 B.T.U./cu. ft. Sufficient gas oil is sprayed in and cracked to raise the calorific value to the normal 500 B.T.U. cu. ft. Experiments are being conducted with residual oils for gas enriching, but so far this has not reached a commercial stage in the U.K.

Agriculture

The fuel oil requirement of the agricultural industry is small compared with the industrial market, but it is growing rapidly and is of vital importance to the country's welfare. Whereas in 1938 there were 55,000 tractors at work in England and Wales, in 1951 the number was 325,000. Over 20,000 of these were powered by diesel engines, and this type is now rapidly replacing those using vaporizing oil.

Apart from its use in tractors and stationary diesel engines, fuel oil is used for drying various crops, such as grass, grain, and hops for storage. Freshly cut grain contains a little over 20 per cent of water, and would mildew if stored in this condition. About one-third of the moisture must be dried out before it can safely be put into store. This was formerly done by exposing the cut sheaves to the sun and wind in stooks, but the combine harvester is now extensively used and this reaps and threshes the grain without any appreciable change in water content. It is therefore necessary to dry the grain artificially by air heated to about 130°F.

Hops are dried in a somewhat similar manner—by warm air at about the same temperature, and the drying kilns or oasts, which are often oil-fired, are familiar features of the landscape in the South East, and the Three Counties.

The artificial drying of good freshly-cut grass has resulted in the production of a feeding stock which has a high protein and carotene content, and can do much to replace imported feeding stuffs. Freshly-cut grass contains about 80 per cent moisture, and this must be reduced to around 10 per cent for storing or milling for cubes. About 4 to 5 gal of oil is used to dry 1 cwt of grass.

Diesel Rail Traction

Perhaps one of the most promising outlets from a coal-saving aspect is that of diesel rail traction, though it has not yet been adopted to any appreciable extent in the U.K. British Railways use about 15½ million tons of coal annually, and it is estimated that 1 ton of fuel oil would replace 5 tons of coal on main line locomotives, or 12 tons for shunting engines.

Future Requirements

Although oil fuels at present provide less than 5 per cent of industry's fuel requirements in the U.K., they are more than proportionally important to U.K. economic welfare, since they are used very largely in the industries which are expected to make the dominant contribution to the export drive. Such industries, if they are to compete in world markets, must be efficient and competitive.

Practically all the estimates of U.K. fuel and power requirements, even though the figures vary, are agreed that available supplies are insufficient to meet the demand if the U.K. is not to lag behind in industrial efficiency and standard of living. The Ridley Report expressed the view that the use of fuel oil would continue to widen. The enormous U.K. refinery programme, now nearing completion, will ensure that the supplies are available.

Around the Branches

FAWLEY, LONDON, NORTHERN, PERSIAN GULF, SCOTTISH, SOUTH EASTERN, SOUTH WALES, STANLOW, TRINIDAD

Fawley Branch

A party from the Fawley Branch recently paid a visit to the Totton Tar Distilleries. They found it a very interesting tour, and during a fairly complicated survey were shown the original crude stills which were installed when the works were first built, as well as the new modifications which are now being introduced. The workshops and laboratories were explored with interest.

Continuing the series of visits to interesting local industrial undertakings, members of the Fawley Branch paid a visit to the Romsey Brewery of Strong & Co. on Saturday, 9 January.

The process of brewing was shown, starting with the water well where the "liquor" (never "water" in brewing) is obtained, and finishing in the barrel stores and bottling department.

The day was particularly suitable since much of the equipment was not in use and could therefore be inspected in detail. Great interest was shown in the coolers, installed in a dust-proofed room, for cooling the wort before fermentation. The cleanliness of the equipment was also favourably noticed.

Not the least enjoyable feature was the samples laid on for refreshment at the conclusion of the tour. One member was heard to remark that he had never obtained such bright, clean-tasting beer in his "local."

Northern Branch

Approximately 70 members were present at a meeting on 19 January when a lecture entitled "Mechanical Handling in the Petroleum Industry" was given by S. J. Treen. The lecture dealt in detail with the types of mechanical handling equipment available to the industry and also indicated the basic advantages to be gained by the intelligent use of such equipment. Mr Treen discussed the economics of mechanization and palletization, and concluded his lecture with a film illustrating the potentialities of mechanization in a light engineering factory.

The meeting was under the chairmanship of J. C. Wood-Mallock.

Northern A.G.M.

The Annual General Meeting of the Northern Branch which was held on 16 February was attended by approximately 75 members. The chairman, J. C. Wood-Mallock, spoke of the numerical strength of the Branch and paid tribute to the enthusiastic members of his committee.

The retiring members of the committee were re-elected, with the result that J. C. Wood-Mallock, chairman; F. Green, secretary, and E. R. Wilson, treasurer, will remain in office during the coming year. One new member, W. E. McAlpine, was elected to the committee.

The meeting concluded with an "Any Questions" programme when the chairman put members' questions to an expert panel consisting of D. Evans, G. H. Harris, Justin H. Wells, and E. H. Wild. Questions ranged in subject from the composition of good gasoline to the use of synthetic oil bases and inorganic gelling agents in greases.

Persian Gulf Branch—Kuwait Annual Dinner

Over 100 members and guests attended the second annual dinner of the Kuwait Sub Branch which was held at the Guest House, Ahmadi, on 9 December. Guest of honour was His Excellency, Mr B. A. B. Burrows, C.M.G., Political Resident, Persian Gulf.

The first speaker of the evening was Lt.-Col. G. C. L. Crichton, C.S.I., C.I.E., Controller of Finance, Kuwait, who proposed a toast to "The Oil Industry." In his speech Lt.-Col. Crichton said that Kuwait was a spectacular example of what the oil industry contributes to the prosperity of the people of the world. The world in general and the Middle East in particular owed a debt to the British and American pioneers who developed the oilfields in these regions.

Mr L. T. Jordan, Kuwait Oil Company, replied to the toast, and was followed by His Excellency Mr B. A. B. Burrows who proposed a toast to the Institute of Petroleum.

KUWAIT ANNUAL DINNER

(Left to right): *J. MacPherson, C. J. Pelly, Lt.-Col. G. C. L. Crichton, His Excellency B. A. B. Burrows, R. M. S. Owen, H. M. Symmes, and Majid-ud Din Jabri.*
(Right to left): *Maj.-Gen. W. F. Hasted, Lt.-Col. H. R. P. Dickson, L. T. Jordan, and Majid-ud Din Jabri.*

Mr Burrows spoke of the potentialities of a body such as the Institute, particularly as a forum for the exchange of ideas from all sections of the community, not excluding the consumer. He then went on to speak of the relations between oil companies and the countries in which oil was found, and emphasized the paramount necessity for there to be partnership between them.

Mr J. MacPherson replied to the toast and this was followed by a toast to the Branch chairman, proposed by Mr T. G. Martin.

Photograph by Wm. Cull

Among those who attended the centenary dinner at Stanlow were: J. C. Wood-Mallock, D. M. Glendinning, E. A. Evans, J. S. Parker, and G. H. Thornley.

Persian Gulf Branch—Bahrain Sub-Area

The 20th meeting of the Bahrain Sub-Area branch was held in the Bahrain Petroleum Company's new theatre on 24 January. R. Godfrey took the chair. In these luxurious surroundings, in a comparatively old-established zone of operations, 64 members and guests heard R. A. Andresen, assistant chief engineer of Caltex, talk on "Some Aspects of Oil Operations in Central Sumatra," a story of pioneering the first shipments of Minas crude from the clutches of swamp and jungle.

The speaker first reviewed the location and war-time history of the Minas field, and told how although a scorched earth policy had not prevented the Japanese from taking over the field, they were unable to surmount the natural obstacles to exploitation.

The crude itself, said Mr Andresen, is reluctant to move, having a pour point of 95° F as measured by conventional laboratory methods, and tends to deposit wax on any cool surface. Special measures have had to be taken to handle this problem oil, including high pressure pipe, positive displacement pumps, and go-devil facilities for use in the event of a shutdown of the line causing wax to build up. With a very tight time schedule to meet and no previous experience to guide them, engineers were anxious to allow for serious trouble but in practice the crude was handled more easily than expected.

Mr Andresen spoke of another barrier which had to be overcome—the 1½ miles of swamp to be traversed between Minas and the Siak river 17 miles away. The problem was solved by the use of thousands of logs which were cut locally to make a "corderoy" foundation to carry pipelines and roads. A sand bar at the mouth of the Siak was a further obstacle necessitating the use of shallow draught tankers which ran a 90-mile haul to an ocean terminal.

Mr Andresen described how the swampy nature of the coast made the erection of wharves and tankage there a further difficulty and how this was overcome by the adoption of reinforced concrete slab foundations surmounting closely spaced timber piles, 990 to an area 160 feet in diameter. Some piles sank 35 to 40 feet under the weight of the hammer before driving commenced. Nevertheless, five 142,000-barrel storage tanks and a T-shaped wharf, 850 × 720 ft, were built and the first shipment was delivered in April 1952.

At the close of Mr Andresen's talk a number of questions were asked which raised further points of interest and R. B. Bennett proposed a vote of thanks.

On the departure of W. D. Clarke, the chairman expressed appreciation of his work as honorary secretary and the members' good wishes to him in his new assignment in Europe. Until the annual general meeting, the Committee has co-opted H. G. Spence as honorary secretary in place of Mr Clarke and K. S. Lennie has been co-opted to the Committee in place of Mr Whitehead who is at present on leave.

Scottish Branch

A meeting of the Branch was held on 26 February when W. H. Thomas spoke on "Recent Advances in the Analysis and Testing of Petroleum."

Mr Thomas was introduced by J. M. Caldwell, chairman of the Branch, who said that no one was better qualified to speak on this subject than Mr Thomas who had been with the Anglo-Iranian Oil Co. Ltd. since 1923. He had served at Research Station, Sunbury; National Oil Refineries, Llandarcy; Abadan Refinery; New York office, and since 1947 had been chief analyst for the company.

Mr Thomas said that analytical trends in the petroleum industry over the last 20 years had been dictated not so much by the economics of laboratory operation and supervision as by the development of new processes, the control of which had necessitated a wider range of analytical procedures and requirements. A further analytical requirement had, moreover, become of paramount importance; that of speed combined with a suitable degree of accuracy.

Spectroscopy had contributed a great deal to the expedition of analytical work, said Mr Thomas. The mass spectrometer could analyse a complex mixture of gases as accurately as by the older methods in only a fraction of the time. It also had considerable application in the analysis of gasoline, gasoline fractions, and high molecular weight materials such as lubricating oils and waxes.

Mr Thomas went on to speak of other speedy methods of analysis such as emission spectroscopy, X-ray absorption as a means of determining sulphur content, and chromatography.

The talk was illustrated with lantern slides and demonstrations, and a vote of thanks to the speaker was proposed by Mr Caldwell at the close of the meeting.

Stanlow Branch

The fifteenth annual general meeting was held at Chester on 29 January with J. S. Parker in the chair.

The chairman presented a report dealing with the activities of the branch during 1953 and this was adopted together with the accounts for 1953.

Two of the three vacancies on the Committee were filled by the re-election of V. Biske and A. J. Ham. C. D. Brewer was nominated for re-election but this nomination had to be withdrawn on Mr Brewer's departure from the district.

The remaining vacancy will be filled by the committee at its next meeting.

Stanlow's One Hundred Up

The fifteenth annual general meeting was also the hundredth meeting of the branch and this was celebrated by an informal dinner after business had been concluded.

Principal guest at the celebration was E. A. Evans, who explained that he was attending in place of Dr A. E. Dunstan who was unable to be present. Mr Evans paid tribute to Dr Dunstan who was instrumental in founding the first branch and delivered the first branch lecture.

A joint meeting with the North West section of the Institute

of Fuel was held at the Grosvenor Hotel, Chester on 17 February. The meeting was organized by the Institute of Fuel and the chair was taken by J. S. Parker, chairman of the Stanlow Branch of the Institute of Petroleum.

A lecture entitled "Exploration for natural gas in the United Kingdom" was given by Dr G. M. Lees. Dr Lees reviewed briefly the principal natural gas fields of continental Europe and explained that, so far, the U.K. findings had been limited to small fields in Scotland and in Yorkshire. Incentive for exploration had, in past years, been slight owing to the difficulty of linking up possible supplies with the user, but with the nationalization of the gas industry the attitude had changed and the Gas Council was actively sponsoring natural gas prospecting. Although over the world as a whole the quantity of gas available was approximately equal to that of oil, as far as the U.K. was concerned even the most optimistic forecasts would not, if fulfilled, make a major change in the country's fuel position. This was essentially based on coal. Nevertheless, said Dr Lees, the gas possibilities were sufficient to make them very attractive.

Dr Lees said that gas could occur either quite alone, in which case it was mainly methane, or else in association with oil, when heavier hydrocarbons were also present. In North Western Europe and the U.K. gas had so far been principally discovered unaccompanied by oil in Permian formations. Search was being concentrated on these but there was also hope of gas and oil being found in the more deeply located carboniferous formations, the exploration of which was more difficult. In certain natural gas deposits the gas issued at 2000-3000 p.s.i., enabling power to be obtained from the expansion of the gas before it was burnt.

Discussion of the paper was opened by N. Simpkin, chairman of the N.W. section of the Institute of Fuel, and a vote of thanks to Dr Lees was proposed from the chair.

Trinidad A.G.M.

The 26th Annual General Meeting of the Branch was held on 22 January. Commenting on the committee's report and the accounts for 1953, the outgoing chairman, A. S. Curlet, said that the last year had not been unsuccessful; membership had increased, an unusually large number of meetings had been held, and attendance at the Annual Dinner was the highest to date. He expressed confidence that the degree of activity achieved in 1953 would be maintained.

By courtesy of the United British Oilfields of Trinidad Ltd. the following films were shown: *Mille Miglia*, 1953; *Harvest for Tomorrow*; *History of the Helicopter*.

Trinidad

At the 157th committee meeting on 26 January, Dr A. L. Down was elected chairman and E. G. Everett was elected secretary for the coming year.

Other committee members are H. C. Costelloe, A. H. Baldwin, H. C. Devenish, W. Andrew, and J. A. Hulme.

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Personal Notes

Russell M. Brown has been appointed general manager of the Refining Division of the California Texas Oil Company, Ltd., a position in which he will co-ordinate the work of the many refineries in which Caltex has an interest.

Mr Brown's last overseas position was that of general manager and vice-president of the Bahrain Petroleum Company Ltd. at the Bahrain refinery. After 16 years service in the Middle East, Mr Brown was awarded the honorary Order of the British Empire in recognition of the outstanding services rendered to British official interests while employed in Bahrain.

J. R. Keith has been appointed assistant general manager of the Refining Division of the California Texas Oil Company, Ltd. (Caltex). Mr Keith's new position in the Company's head office in New York is the latest step in almost 25 years of refining, research, and administrative experience. Mr Keith joined the Texas Company in 1929 and was transferred to Caltex in 1937.

C. H. S. Haygarth, deputy general manager of Shell-Mex and B.P. Ltd., has, with the consent of his Company, accepted the appointment of managing director, Pump Maintenance Ltd., an independent organization recently formed with the object of providing a maintenance service for pump and tank equipment.

Photographer's Visit to Philippines and Japan

Derrick Knight, M.B.E., A.I.B.P., F.R.P.S., chief photographer of the Shell Photographic Unit, is to carry out a tour of the Philippines and Japan. The object of his mission is to obtain an up-to-date record of current oil operations and also to cover as much as possible of the topographical and social background of the two countries.

Derrick Knight photographing a tanker under construction.

T. R. C. Tompkins, manager of the automotive sales department of the Vacuum Oil Co. Ltd., showing his friends the gold watch awarded to him after 40 years service with the Company. Mr Tompkins is third from the right in this picture.

W. D. Clarke, who until recently was in charge of research and development at Bahrain refinery, has been transferred to Europe to head a new technical service department covering Caltex activities in Europe. He will be located at Pernis. Mr Clarke was honorary secretary of the Bahrain Sub-area, Persian Gulf Branch of the Institute before his transfer.

G. J. Chamberlin, managing director of The Tintometer Ltd., is to attend two scientific meetings during a business visit to the U.S.A. this summer. He will attend the Convention of the ASTM in Chicago from 14-18 June, and also plans to be present at the meeting of the Canadian Institute of Chemistry in Toronto from 21-23 June.

P. R. Drew, O.B.E., T.D., has been elected to the Board of Directors of Shell Tankers Ltd. and appointed manager of the Chartering and Freight Department.

He joined the Royal Dutch/Shell Group in March 1946 and, before taking up his present appointment, was a member of the management of the Fuel and Light Oils Department of The Shell Petroleum Company Ltd.

Many of our readers will recognize (left) *Comdr R. E. Stokes-Rees, secretary to the IP* 1921-33, *and his wife* (right). *Now in his 76th year and living in Magherafelt, County Derry, N. Ireland, "Stoker" has taken up model-making as a hobby and, naturally, has chosen ships. His model of the frigate "Constitution" was accepted by the U.S. Navy for the London office of the U.S. Naval Attaché, and is seen being accepted by Lieutenant W. H. Noel, senior U.S.N. officer in Londonderry, and his wife.*

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KUWAITI STUDENTS GATHERING

Forty-three Kuwaiti students from various parts of Britain attended a special gathering in London recently to celebrate the fourth anniversary of the accession of their ruler, His Highness Shaikh Abdulla as-Salim as Sabah.

The students were the guests of the Kuwait Oil Company and were welcomed by the Company's managing director, Mr C. A. P. Southwell. The celebration programme included a visit to the de Havilland Aircraft works at Hatfield and the photo shows the party grouped near a B.O.A.C. "Comet".

Any Matches?

NO MATCHES . NO LIGHTERS . NO SMOKING

By **V. BISKE** (*Fellow*)

As we enter a refinery or an installation in which petroleum spirit is stored, we are (or should be) faced with this notice, or one closely similar, usually in red on a white background (incidentally why, if maximum clarity is desired, not follow the practice of certain road signs and use black on yellow). It may be of interest briefly to consider the legal sanction (if any) behind these words.

By s.2 of the Petroleum (Consolidation) Act of 1928 the granting of licences for the storage of petroleum spirit is vested in the local authority who "may attach to any petroleum-spirit licence such conditions as they think expedient . . . generally as to the safe-keeping of petroleum spirit."

Licensing Conditions

The granting of such local autonomy in the matter of the issuance of licences has resulted in a wide variety of conditions being attached to such licences. In many cases such conditions are, from the viewpoint of a petroleum technologist, quite sound. In other cases the conditions, whilst reasonable for a small filling station, are ludicrous when applied, say, to a refinery. It is open to the applicant, if he is dissatisfied with the conditions on which the licence has been granted, to appeal (s.3 of the Act) to the Secretary of State who, for this purpose, is the Home Secretary.

Nevertheless, despite the variety of conditions which are, in practice, incorporated in licences, it will be found that there is always a clause prohibiting the bringing in of matches or lighters, or of smoking (except in permitted places) on the licensed premises; sometimes moreover there is a requirement in the licence that matches, lighters, and smoking materials shall be deposited at a specified place (*e.g.* the office or the gate patrol) on entering the licensed premises.

It is a requirement of the Act (s.2 (4)) that when conditions which have to be observed by persons employed are attached to any petroleum-spirit licence, then a notice setting out such conditions must be kept posted on the premises to which the licence applies, the notice being so situated that it may be easily read by persons employed on the premises.

Provided that this requirement is complied with (and it can cost the occupier £5 per day if it is not) then any person employed on the premises who contravenes any condition of which notice has been given may be liable to a fine of up to £5 (s.2 (4) (c)).

So far, so good. An employee enters a refinery, is asked whether he has any matches, etc., replies "No" and proceeds to his work. Let us assume that he has replied falsely and is, in fact, in possession of a box of matches. He has, undoubtedly, committed an offence, and is therefore liable to prosecution (in accordance with the general principle of English criminal law such prosecution could be initiated by anyone who cared to do so, it need not be the police, it could be the employer or for that matter a fellow-employee).

Detection of Offenders

We now, however, face the difficulty of how is such an offence to be detected? The Act does not confer a right of search (as is for instance the case for coal mines, see Coal Mines Act 1911 s.35; S.R. & O. 1912 No. 510); hence no company patrol can search an employee without the consent of the latter. It may be that the right of search has been reserved by the employer in the contract of employment he has made with the employee. This, in fact, does not much assist in enforcing the provisions of the licence. If an employee has no matches and has, in his contract with the employer, agreed to submit to search on request, then he will presumably readily agree. If, however, he does happen to be carrying matches, etc., then despite the term in his contract of employment he can still refuse to be searched. Such refusal is of course a breach of his contract, for which he can be dismissed, or, technically, sued in a civil court. If he is in fact carrying matches and he does submit to search, it is almost certain that he will be dismissed in any case (unless he has permission to carry the matches for some official purpose, in which case one presumes he would not be selected for search); he will in addition also render himself liable to prosecution for contravention of one of the conditions (to be observed by employees) under which the petroleum-spirit storage licence has been granted to his employers.

We thus come to the conclusion that it may well, in a case where the right of search has been reserved by the contract of employment, pay an employee who is carrying matches, etc., to refuse to allow himself to be searched, since if he so refuses the worst that can befall him is that he will lose his job, whereas if he does agree to search he may both lose his job and be prosecuted on a criminal charge.

It hardly seems necessary to state that any attempt by an employer to search an employee without the consent of the latter (even if such consent had previously been implied by agreeing to the conditions of employment) would constitute an assault. Moreover, even if refusal to submit to search were taken as an admission (which might not be the case) of a breach of s.2 of the Act, this is not an offence for which an arrest can be made. As regards the searching of, for instance, an employee's coat which may be hung up away from where he is working, such would be, without the permission (express or implied) of the employee concerned, a trespass to chattels and actionable as such without proof of any special damage.

Thus, so far as an employee is concerned, it appears that the true sanction behind the prohibition on matches is not a prosecution under the Act but the possible loss of his job; as, in the former case, the maximum penalty is only £5 there is little doubt that what, in effect, is the only really applicable penalty, is the more severe one.

Visiting Persons

We have dealt with the position of the employee. Now let us consider the visitor. In his case it seems that even if he does take matches into a refinery he is not committing any offence at all. The Act (s.2 (4) (c)) limits the penalty for contravention of licence conditions to "any person employed," although, *any* person (*i.e.* employed on the licensed premises or not) is liable to a £5 fine for defacing a notice posted in accordance with the requirement in the Act of making known the conditions under which a petroleum-spirit storage licence has been granted.

We thus have the somewhat surprising situation that if A, a visitor at B's refinery, defaces the "No Smoking" sign at the gate, he is liable to pay £5, but if he goes into the refinery, and smokes there, he is not liable to any penalty at all!

If the licensee admits to the licensed premises a person whom he knows to be carrying matches then he is committing an offence against s.1 (3) of the Act and is liable to a penalty of £20 for every day on which such contravention occurs. It does not however appear as though the erring visitor himself were liable to any penalty at all. Obviously, if his error is discovered whilst he is on the premises he may be asked to leave immediately,

but the right of the occupier in such a case is merely that possessed by any occupier of any premises, where a visitor (other than a person entering as of right) may be asked to leave without any reason being assigned, if the occupier so thinks fit.

If the visitor is a person who does enter as of right (for instance a customs officer) then it seems that, even if he were to smoke on top of a spirit tank, the occupier is in a position of difficulty. If we examine the legal implications of such a fantastic situation, it seems as though the customs officer cannot be removed from the refinery, since he is empowered to examine any vessel at any time (regulation 7 of the Hydrocarbon Oils Regulations 1948). In fact, the only course open would appear to be to summon a constable and, on the assumption that any person behaving in such a manner is of unsound mind, request the constable to exercise his powers of immediate arrest under s.15 of the Lunacy Act 1890!

Responsibility for Deposited Articles

Reverting, however, to more likely situations, let us now briefly consider the position of the licensee in respect of his responsibility for the safe keeping of matches, etc., entrusted to him by employees and others entering upon the licensed premises. In the case of matches, the value of the article in the custody of the occupier is of course trivial and unlikely to lead to any argument if it were lost. However, lighters are common and, in the case for instance of a wealthy visitor, the value of a lighter (*e.g.* of gold) could be considerable.

It seems clear that the occupier of the premises is in the position of a bailee, but the extent of his responsibility will depend upon the status of the person from whom he has taken the lighter. If such person is an employee then we may consider that, as it is a term (implied or otherwise) in the employee's contract of service that he will not take a lighter into the refinery and since the occupier will, in the majority of cases, have provided facilities (by means of pigeonholes, etc.) for the deposit of such objects at the gate, the occupier is under a greater obligation, since the bailment is contractual, than he would be to a visitor, in whose case the bailment is gratuitous. In the former case he would be expected to take as much care of the object entrusted to him as a man of normal prudence would do in similar circumstances, whilst in the case of a visitor, where the occupier is presumably in the position of a gratuitous bailee, he would only be liable for that extent of negligence which can be described as "gross."

The position of the occupier if his gateman gives a lighter to a person other than the depositor, with consequent liability for conversion, is a matter which is outside the scope of this note.

In conclusion we may say that, since the advisability of keeping matches out of refineries is generally recognized, the practice of surrendering these as one enters works smoothly although, as we have seen, there are considerable difficulties in penalizing an offender. As regards smoking, this is easier; being a visible act, it is a simple question of fact to decide whether a given person was or was not smoking in a certain place. If such person is an employee of the occupier of the licensed premises he has committed an offence and can be dealt with under the Act (on the assumption of course that smoking is prohibited by the terms of the petroleum-spirit storage licence and that such prohibition has been posted on the premises). If the injudicious smoker is a visitor, all that can be done is to ask him to leave, and presumably, not to invite him again.

N.B.—The above applies to premises in the U.K. licensed for the storage of petroleum-spirit (*e.g.* refineries, distribution depots, filling stations, etc.). Different regulations apply to harbours, tanker vessels, canal barges, and road tankers; in some such cases the carrying of matches, smoking etc., is an offence, irrespective of whether the person concerned is an employee or not.

A Shell photo

The largest fractionating column ever to be shipped from the U.K. to India began its journey recently from the Port of London to the new Bombay oil refinery of Burmah-Shell Refineries Ltd. The column weighs 65 tons and has a length of 110 ft and a diameter of 10 ft 6 in. Photo shows the fractionating column on the deck of s.s. "Jalaketu" (7180 gross tons) at King George V dock in the Port of London.

An Anglo-Iranian photo

This roadway, under construction at the new Kwinana oil refinery, Freemantle, will connect the refinery to three jetties which are being built a quarter of a mile off-shore.
The new refinery is being constructed for the Anglo-Iranian Oil Company's associate, Australasian Petroleum Refinery Ltd.

Trade Literature, etc.

Urea Production

A booklet describing a new "ammonia-saturated" process for the production of urea has been published by the M. W. Kellogg Company, 225 Broadway, New York 7, N.Y., U.S.A. The new process is a partial re-cycle system and the explanatory booklet contains a simplified flow sheet showing the principal items of equipment involved.

Plunger Lift

In a bulletin issued by the National Supply Company, Gateway Center, Pittsburgh 30, Pa., details are given of the Ideal plunger lift method for producing oil from wells with supplies of gas under pressure. The bulletin is fully illustrated and shows various features of the equipment, such as the pressure cycle controller, as well as the method of lift operation.

"Dutrex" R

The results have now been published of experiments in the use of a non-volatile petroleum derivative, "Dutrex" R, in rubber processing. "Dutrex" R has been developed in the Shell laboratories and can be used both as a processing aid for raw stock and as a softening agent for vulcanisates.

A specially-produced booklet gives an account of the results obtained by using "Dutrex" R as a softener in a selection of natural rubber mixes, and the various properties resulting from the incorporation of "Dutrex" R are set out in tables.

New Insecticide

Aldrin, a new insecticide which has been effectively used to control locusts and grasshoppers, is described in an illustrated booklet published by Shell. It can be sprayed as a solution or applied as dust or bait.

West Indian cricket may benefit from the advent of this insecticide for it is to be used to check the activities of the mole cricket—a turf-burrowing insect which has made it impossible to maintain grass wickets in Trinidad. If experiments with Aldrin succeed, turf may replace matting for future test match series.

Rope for Accra

A huge coil of rope, 4000 ft long and weighing almost five tons, has been shipped to Accra on the Gold Coast for use in conjunction with a submarine oil pipeline now under construction.

The rope has been supplied by British Ropes Ltd. and will be used to tow out a pipeline to a standpipe erected at sea to enable oil to be pumped ashore.

New Resins

A new series of resins, the Epikote resins, has been developed by Shell laboratories. They represent a new class of condensation polymer and can be used to produce a variety of both air-drying and stoving finishes. The properties of the new resins and methods of application are discussed in an illustrated booklet which gives details of experimental results and contains a number of reference charts.

Teepol

Teepol in Industry is the title of a booklet issued by Shell to publicize the ways in which this agent can be useful in many different trades and processes. Teepol is primarily useful as a detergent and is therefore particularly helpful in laundrywork, general cleaning, textile processing, etc., but it has many other important uses in the building, engineering, mining, rubber, and paper-making industries. One interesting way in which it is used is, for example, as a foaming agent in the production of cellular concrete—a relatively new building material.

Elongation Measurements

Data for the inter-conversion of percentage elongations corresponding to different gauge lengths of steel have been printed in convenient form on a small, durable card and envelope produced by Stewarts and Lloyds Ltd.

The data have been taken in summarized form from BS 806: 1954, Appendix D. It is hoped that by facilitating the conversion of tensile test results to a rational basis and so making them comparable the card will help to rationalize the specifying of percentage elongations in the U.K.

Automatic Pipette Control

An automatic pipette control, the Pumpett, has been devised to replace the present practice of filling pipettes by mouth.

The new control has been produced by the Shandon Scientific Company, 6 Cromwell Place, London, S.W.7. A lever-operated chuck enables all types of pipette to be filled and a micro-control screw valve is provided so that filling can be accurately controlled.

Organic Chemicals Catalogue

The 1954 catalogue issued by L. Light and Company, Ltd., Poyle Estate, Colnbrook, Bucks., covers a wide range of organic chemicals of interest to research workers.

ASSAM OIL SEARCH

The new well at Nahorkatiya

Following the discovery of deep oil at their No. 1 test late in 1953, the Assam Oil Company are drilling this first development well at Nahorkatiya, on the banks of the Dihing River. The new well, scheduled to go to 10,000 feet, is part of the Company's intensive programme of exploration in the alluvial areas of the Brahmaputra Valley in Upper Assam. Simultaneously with drilling operations, seismic, gravimetric and aeromagnetic surveys are now in progress, and helicopters are employed to speed up the transportation of men, materials and instruments to different places in the region.

Books and Films

Some Unsolved Problems

Available without charge from ASTM headquarters, 1916 Race Street, Philadelphia 3, Pa., U.S.A., is this 24-page booklet on "Some Unsolved Problems." Compiled by the Administration Committee on Research, it is designed to stimulate studies of properties of materials on which data is needed. In each case, the problem is stated, present knowledge outlined, questions which need to be answered are given, and introductory references are quoted. Among the many problems are storage stability of oils containing pour point depressants under fluctuating temperature conditions; adhesion of asphalt to coarse aggregate; measurement of rheological properties of bituminous materials; rapid appraisal of weatherability of asphalts.

Preservation and Packaging

Advice on the packaging of goods for transport and storage overseas is contained in a handbook entitled *Preservation and Packaging for Export and Storage*, published recently by The Shell Petroleum Company Limited.

Although the handbook does not set out to give any considerable amount of technical data, it deals in some detail with the various problems of preservation, packaging, and transportation. Sections are devoted to the following subjects: the main causes of damage to materials; treatment for the prevention of corrosion; the selection of the correct type of package; inner packaging; and marking and strapping.

The text is illustrated with diagrams showing ways of constructing wooden crates and cases of various types.

Packaging Film

The need for good packaging of export goods is also emphasized by The Shell Petroleum Company in a film entitled *Handle With Care*. This shows what happens to goods in transit and emphasizes the main points to which those responsible for packaging should give their attention.

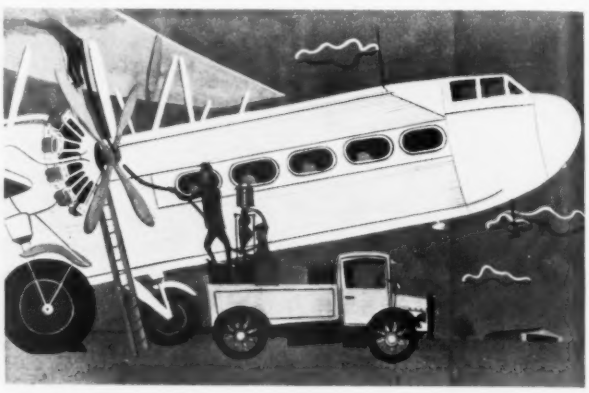
The film can be obtained on loan, without charge, through The Petroleum Films Bureau, 29 New Bond St., London, S.W.1.

Power to Fly

This Helas and Batchelor cartoon film, made for Anglo-Iranian Oil Co. Ltd. and available from Shell-Mex and B.P. Film Service, tells in a most fascinating manner the story of man's effort to acquire the power to fly. It was not until 300 years after Leonardo da Vinci's studies of bird flight that Sir George Cayley established with the first glider the rigid wing principle. A steam-driven machine was flown by Stringfellow in 1848 but it was not until 50 years later that the Wright Brothers solved the problem of control in the air. Between these achievements were many attempts to emulate the bird and this film depicts them in full colour in the space of 20 minutes.

Courtesy Anglo-Iranian

Hiram Maxim's giant (1896) *from "The Power to Fly".*



Courtesy Anglo-Iranian

Handley Page "Hannibal" (circa 1930) *from "The Power to Fly".*

The Back of Beyond

Conditions of life in inland Australia, with its extremes of heat and cold and alternating droughts and floods, demand a special type of people prepared to withstand the rigours of the climate and the barren desert land, as well as the physical and mental isolation which is the lot of the pioneer settler.

In producing a film of life on the Birdsville track, which stretches 300 miles across the north of South Australia, the Shell Film Unit has presented a cameo of life in inland Australia. Following the journey of the local Royal Mail truck from Marree in South Australia to Birdsville in Queensland, the film shows, by reality and myth, both present-day conditions and some of the history of the isolated groups of settlers raising cattle and sheep along the track.

The dominating feature of the film is the land itself; ruthless, unrelenting, and scattered with the skeletons of its animal and human prey, it is stubbornly unwelcoming to human intrusion.

The nature of the land and the character of the people who battle with it are presented in this film with obvious authenticity in imaginative documentary form.

No decision has yet been made with regard to the distribution of *The Back of Beyond* in the U.K. Enquiries on this point should be addressed to the Shell Petroleum Company Limited, Public Relations Department, Shell-Mex House, Strand, London, W.C.2.

Trawlers at Spithead

Trawlers at Spithead shows the meticulous preparations which took place before two Fleetwood trawlers, *Red Hackle* and *Princess Royal* set off to represent the fishing fleets at the 1953 coronation review and the proud place they took among the larger ships at Spithead.

This film is available on loan from the head office and divisional offices of Shell-Mex and B.P. Ltd.

Chemical Engineering

PART IX—ADSORPTION

By **D. C. FRESHWATER**

Certain solids have the property of holding on their surfaces appreciable amounts of gases, vapours, or liquids. This phenomenon is called adsorption and since different solids are highly selective in the compounds which they will attract and hold in this manner, the effect can be used for the separation of mixtures of substances in a given fluid. The nature of the surface forces which cause material to be adsorbed on various solid adsorbents is by no means fully understood. This, however, has not prevented the industrial application of adsorption as a unit operation and it has become of considerable importance in petroleum refining. Typical applications are the decolourization of high-grade lubricating oils, the removal of gums and potential gum-formers from gasolines, and catalysis in cracking operations.

Theory of Adsorption

Adsorption is generally expressed quantitatively as the amount of material adsorbed per unit weight of adsorbent at a constant pressure and temperature.

The earliest attempt to describe the process of adsorption mathematically is the exponential equation attributed to Freundlich. This may be written as $x = kc^n$ where x is the amount adsorbed per unit wt of adsorbent, c is the concentration of the component being adsorbed in the medium in contact with the adsorbent, and k and n are constants. These constants have to be determined experimentally for different systems. This relationship is almost wholly empirical and cannot cover the whole range of observed phenomena. Many cases exist which do not conform to this type of expression; nevertheless, the Freundlich equation is used quite extensively in practice, particularly in the case of adsorption of liquids.

Gibbs, by thermodynamic reasoning, obtained a theoretical expression for adsorption based on the physical properties of the adsorbent and the adsorbed material. However, since it includes the surface tension between the two substances, the equation is difficult to apply as very little information exists on the surface tension between a solid and a liquid

Considerable attention has been given to explanations of adsorption by analogy with surface tension phenomena in capillary tubes. It is well known that the vapour pressure over the meniscus of a liquid in a capillary tube is lower than the vapour pressure of the liquid in a free space at the same temperature. Thus it was argued that when a gas is brought into contact with an adsorbent, which is essentially a highly porous solid, the gas should condense in those pores which have sufficiently small radii. However, this explanation does not apply where adsorption occurs when the gas is above its critical temperature.

Where the material adsorbed is a gas or vapour it is convenient to show the characteristics of a given system by plotting volume adsorbed against pressure, at constant temperature. It is found that there are five types of isotherms, as these graphs are called. These are shown in Fig 1a-e.

The most widely accepted modern view of adsorption is that known as the multimolecular layer theory evolved by Brunauer, Emmett, and Teller. Detailed consideration is beyond the scope of this article, but the more important aspects of this theory may be noted. It is assumed that if adsorption is taking place on a free surface, first a monomolecular layer forms and then multimolecular layers which can be formed below the saturation pressure. Equations have been derived to cover all five types of adsorption isotherms. Physical adsorption of the first molecular layer of gas is determined, firstly, by the nett heat of adsorption and, secondly, by the surface of the adsorbent.

It should be stressed that this applies only to gas or vapour phase adsorption.

Adsorbents

Numerous substances exist which are known to possess marked or appreciable adsorptive properties. These may be divided generally into two classes: those derived from living matter and those of mineral origin. Among the former class are animal and vegetable charcoals, used particularly in vapour phase adsorption, and diatomaceous earth. Practically all liquid phase

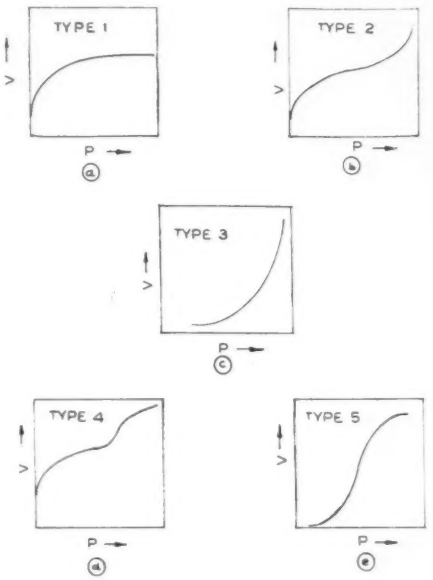


Fig 1. *Absorption isotherms.*
V = *volume adsorbed*, P = *pressure.*

adsorption processes use mineral adsorbents which are naturally occurring compounds subjected to a careful preparation treatment. The more important of these minerals are fuller's earth, bentonite, bog iron ore, and bauxite. Most of these are sold under various trade names. The fuller's earth may be suitable also for the treatment of vegetable or animal oils, whilst others are generally limited to use with petroleum oils. The former type can be adapted by proper chemical preparation to give excellent media for the treatment of mineral oils.

The importance of surface area of an adsorbent was mentioned in the previous section on adsorption theory.

Surface areas may be determined by the application of the Brunauer, Emmett, and Teller equation, using nitrogen at low pressures, and also by methods such as measuring the rate of solution of a known weight of adsorbent or the permeability of a fixed bed thickness to flow of gas (see later article on Filtration). Some values of surface area for typical adsorbents are shown in Table I. The bulk density and apparent density are also shown, and give an indirect measure of the surface area.

One other physical property which is important in the mechanics of adsorption processing is the particle size range. This is determined by sieve analysis for the larger sized particles and by elutriation for very small sizes.

Preparation of Adsorbents

Most adsorbents depend for their efficiency on special preparation methods. These are almost always physical treatments of drying, grinding, and roasting, but clays are sometimes treated chemically with acid or alkali to improve their "activity." A typical flowsheet of clay processing is shown in Fig 2.

Table 1

Adsorbent	*Surface Area sq.m/g*	*Bulk Density lb/cu.ft.*	*Apparent Density lb/cu.ft.*
Silica gel . .	580-620	50	70
Charcoal . .	700-800	25	45
Prepared clay .	600-1000	53	110
Bauxite . .	150-200	70	100
Fuller's earth .	100-150	31	120

Methods of Using Adsorbents

The processes of refining by adsorption may be divided into those where the material being treated is a liquid and those where it is a vapour, or at least where the adsorption takes place whilst the treated material is in the vapour phase. Processes of the former type are the oldest and still the most widely used and will be considered first.

Liquid Phase Treatment

Modern processes use two methods known respectively as percolation treatment and contact treatment. Percolation, as the name implies, consists of passing the oil to be treated (preheated if necessary) through a fixed bed of granular adsorbent contained in a suitable vessel. The undesirable constituents are removed from the oil during its passage through the bed of adsorbent, but after a time the latter becomes saturated and no further refining can take place. The flow of oil is then stopped and another freshly charged percolation unit is brought on stream. After the used percolator has been allowed to drain, the adsorbent is washed with naphtha and then steamed to remove all the oil adhering to it. It is then removed from the vessel and ignited at about 1100° F to burn out all the impurities which have been adsorbed. After cooling, the adsorbent is returned to the percolation vessel and is ready for re-use.

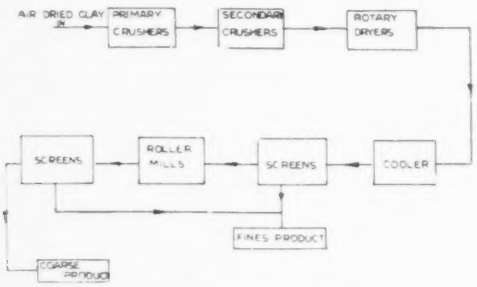


Fig 2. Flowsheet of clay preparation.

The flow of oil through the bed may be from the top to the bottom of the percolator or vice-versa, *i.e.*, gravity or anti-gravity filtration. The latter is generally preferred because of the greater evenness of flow which is associated with it.

The temperature of the oil during treatment is important and the optimum value is determined experimentally for each particular stock. For most lubricating oils it is found that the best treatment temperature is between 110° and 130° F. Percolation treatment is generally applied to lubricating oils, waxes, and occasionally to kerosines, but rarely, if ever, are gasolines treated by this method.

The usual adsorbents for this process are bauxite, or one of the varieties of fuller's earth, but a suitable size range must be selected. Although it appears that the most finely ground material has the greatest efficiency, weight for weight, it is usual to choose a material with a fairly wide range of particle size in order to obtain a suitable rate of flow for the product being treated, as this controls the length of the time of contact.

In the contact method the adsorbent is always in a much finer state of subdivision than in percolation and is generally about 200 mesh or less (*i.e.*, particles having a characteristic dimension of 0·0029 inches or less). A further contrast between the two processes is that contact filtration is used largely for treating kerosine and, occasionally, straight-run gasolines, in addition to lubricating oils of various grades.

The contact method consists of mixing the oil and adsorbent by mechanical agitation and then separating the adsorbent by centrifuging, filtering, or sedimentation. The time of contact is only a matter of minutes, the longest time being required for the heaviest oils. Whilst gasolines and kerosines are contacted at normal temperatures, the treatment temperature for lubricating oils is 250-350° F and may be as high as 600-700° F for very heavy oils.

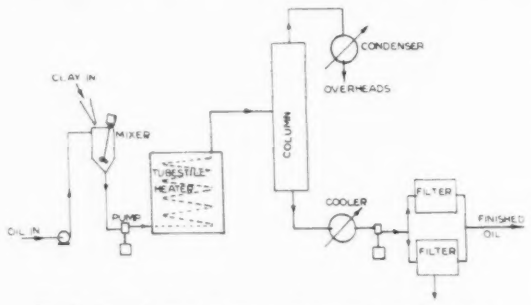


Fig 3. Simple line diagram of contact treating plant.

This treatment may be carried out in a tubular furnace and a diagram of a treatment plant of this type is shown in Fig 3.

From the above description and diagram, it can be seen that contact treatment is continuous as opposed to the semi-continuous operation of percolation. Many variations on this basic method are practised at various refineries, but the essential procedure is to mix the lubricating oil with the adsorbent and pass the mixture through a tubular furnace. The heated mixture passes to a column (generally under vacuum) and the lighter fractions are taken off as vapour whilst the heavy residues, together with the adsorbent, leave the base of the tower. The adsorbent is subsequently separated from the heavy oil by filtration.

Vapour Phase Refining

The most important of these processes are the recovery of propane and butanes from natural gas, the purification of cracked gasolines in the vapour phase and, occasionally, the recovery of C_2 to C_3 hydrocarbons from refinery gases.

In the second process—the Gray process—the petroleum vapour is passed through a tower packed with a suitable adsorbent which removes colour, gum, and some sulphur compounds. The purified vapours are then condensed in the normal way. The operation of the adsorbent-packed tower is intermittent as is percolation treatment.

Activated carbon is used for the separation of liquid hydrocarbons from gaseous hydrocarbons as it has a pronounced selectivity for the adsorption of appreciable amounts of volatile hydrocarbons at low pressures, which enables it to compete with absorption processes using gas oil and similar products. Moreover, with activated carbon, saturation of the adsorbent with successively higher homologues of methane occurs as the time of contact increases. Thus, if the carbon is passed countercurrent to the gas, a process analogous to fractional distillation may be accomplished. A continuous process has been developed for the separation of components of natural and refinery gases. This is the hypersorption process and is carried out over a moving bed of activated charcoal which recycles through the apparatus. A diagram of a simple hypersorption unit is shown in Fig 4.

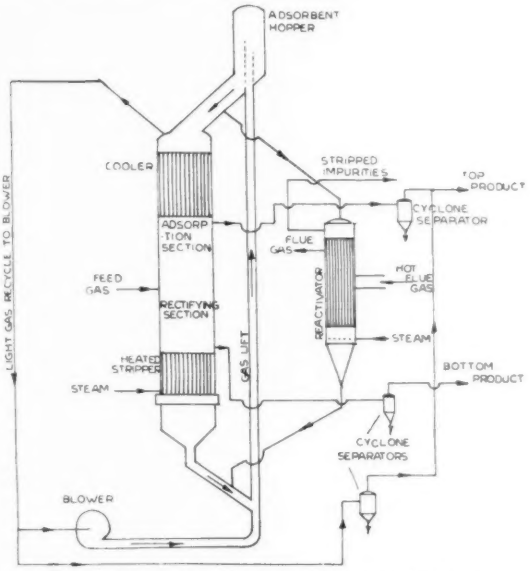


Fig 4. Simple line diagram of hypersorption unit.

The feed gas enters at the bottom of the adsorption section and as it passes upwards all the hydrocarbons higher than CH_4 are adsorbed. The adsorbent meanwhile passes down the tower and enters the rectifying section where it contacts vapour liberated from the carbon near the base of the tower. The lighter hydrocarbons are driven out and replaced by those of higher molecular weight. The vapours evolved leave the top of the rectifying section as "top product" whilst the adsorbent, now saturated with these heavier components of the original feed, passes into the stripper. Here the activated carbon is heated to drive off all the adsorbed material, steam being introduced at the base of the stripper to assist this process. The heavier hydrocarbons so released leave the tower as "bottom product" at the top of the stripping section, in an amount sufficient to maintain the material balance. The remainder passes up the tower to drive the light components out of the adsorbent in the rectifying section. This may be considered as analogous to reflux in a distillation column. The activated carbon tends to lose some of its adsorbing power during this repeated adsorption and desorption process and so part of it is by-passed through a reactivator where it is heated to a temperature of 1000° to 1300°F to restore its efficiency.

This necessarily brief description covers only the main outline of the hypersorption process and for further details reference should be made to one of the standard texts given at the end of this article.

The adsorption process has now been in use commercially for several years and is an important new chemical engineering technique. As in many other fields, petroleum refining has played a considerable part in developing the unit operation of adsorption. This operation is of growing importance and modern techniques which originated in petroleum refining are spreading to other fields.

For further reading see:—

Mantell, C. L., "Adsorption," McGraw-Hill Publishing Co., 2nd edition, 1951.

Kalichevsky, V. A. and Stagner, B. A., "Chemical Refining of Petroleum," Reinhold Publishing Corporation, 2nd edition, 1942.

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USBM Policy on Synthetic Liquid Fuels

Fundamental laboratory and pilot plant research on producing liquid fuels from coal and oil shale is to play an important part in the future USBM programme for producing synthetic liquid fuels. This information was given recently by the Secretary of the Interior, Secretary McKay, when he outlined future American policy in this respect.

Secretary McKay also announced that he was not to request extension of the Synthetic Liquid Fuels Act, due to expire in April 1955. The Bureau's organic legislation appears to contain ample authorization for the studies contemplated.

Co-operation with private industry, stated Secretary McKay, is to continue through co-operative projects and frequent technical discussions. Private industry will, moreover, be encouraged to assume primary responsibility as soon as any project reaches the stage of advanced development.

The specific procedures outlined by the Secretary for the research include the following:

1. *Coal to oil research programme.* Work is to be continued on direct hydrogenation of coal and on the synthesis of liquid fuels from gasified coal within the Bureau's laboratory facilities.

Pilot plants will be confined to small-scale facilities of the type needed to supplement laboratory work.

2. *Coal gasification programme.* Laboratory research and pilot plant runs will be continued.

3. *Oil shale programme.* No further large-scale mining development will be undertaken.

The oil-shale mine at Rifle, Colorado, will be operated primarily to supply material for the retorts. Development of a new mining procedure on paper is authorized for the current fiscal year.

Laboratory research on oil shale will be continued.

Retorting of oil shale at Rifle, Colorado, will continue until the practicability of the Bureau's new retorting equipment has been reasonably demonstrated. Large-scale shale oil refining work will be discontinued.

The plans outlined are in keeping with the earlier decision to discontinue the operation of demonstration plants and to confine the Department's research and development programmes to those that industry cannot be expected to undertake at this time. In addition, they follow the historic Bureau of Mines policy of dropping research and development projects as soon as they have reached an industrially competitive status.

Manchester's New Oil Dock

The new oil dock, Queen Elizabeth II, which was opened at Eastham on the Manchester Ship Canal on 19 January, is the largest in Great Britain. It has four berths each of which can accommodate a tanker of 30,000 tons and over.

The ceremony of opening the new dock was performed by the s.t.s. *Velletia*, one of Shell's 28,000 tonners, which broke the tapes to be the first vessel to enter the dock. She carried a cargo of Kuwait crude.

Covering an area of 18¼ acres, the dock is in the form of a square, the four berths being 800, 725, 900, and 730 feet in length respectively. Depth of water in the dock is 40 feet and the approach from the Mersey is by a channel dredged to a depth of 15 feet below Liverpool Bay datum. This approach channel has a depth of water of 44 feet at high water and a width of approximately 500 feet. The entrance lock is 807 feet in length and 100 feet wide. The lock is controlled by three sliding gates, each weighing 1700 tons and these can be opened or closed electrically in three minutes.

A Shell photograph

Oil company pipelines serve three of the berths and land is available in the vicinity of the dock for the erection of storage installations, etc.

Safety Precautions

As a safety measure "oil weirs," the first of their kind in the world, have been installed at each corner of the dock. If oil should spill from a tanker, a "reverse penstock" operates and sucks the surface oil-water mixture into chambers deep in the concrete walls of the dock. Here the oil can be skimmed off safely.

Also, drip trays have been installed at each pipe manifold, and oil collected in them is gravity fed into the oil weirs. Foam units are provided at each berth.

Other Oil Docks

The first oil dock in the Manchester Ship Canal was built in 1922 to provide for the handling of low-flash petroleum products at Stanlow. A second oil dock was built eleven years later to cater for the large increase in the petroleum spirit traffic of the Port of Manchester.

Since the last war the development of the refining industry and the increase in the size of tankers have brought with them the need for increased facilities in the Port and the Manchester Ship Canal Company decided to build the new dock. Work on it started in November 1949.

Opening Addresses

These developments were referred to by Sir Leslie Roberts, C.B.E., chairman and managing director of the Manchester Ship Canal Company, in his luncheon speech following the official opening of the dock. It was during the immediate post-war years, Sir Leslie said, that the testing time came and decisions had to be taken. It was at first believed that the American initiative in building larger tankers would have little effect upon the British oil trade, but as time went by dollar stringency and technological developments in petroleum refining led to a change in government policy. An extensive programme was approved for the establishment of refineries in Britain and it was under this programme that work was begun on the refinery at Stanlow. The development of the refining industry and the arrival of "the era of the big tanker" together led to the building of the new dock.

Sir Leslie said that there were two phrases which he had always liked: "Success brings Success," and "Trade follows the Flag." "Today," said Sir Leslie, "we have the flags of all the oil companies proudly floating in the breeze . . . We are ready waiting and the lock gates can be opened quickly."

Replying to a toast to the visitors, F. J. Stephens, a managing director of the Shell group, said that Manchester, an inland city, had now become the second oil port in the United Kingdom and was also one of the greatest oil ports of the world. The new dock and lock with their attendant facilities were indeed an elaborate unit, said Mr Stephens, but nothing less would have been sufficient to keep Stanlow supplied with cargoes.

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INDUSTRIAL SAFETY

A new institution, the Institution of Industrial Safety Officers, has recently been formed with a founder membership of 500 executive-grade persons engaged in accident prevention in industry.

Activities similar to those of this new and separate body have previously been conducted as a section of the Royal Society for the Prevention of Accidents.

Enquiries concerning membership and the activities of the Institution should be addressed to 52 Grosvenor Gardens, London, S.W.1.

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EDINBURGH CHAIR OF CHEMICAL TECHNOLOGY

The University Court of the University of Edinburgh has approved the foundation of a Chair of Chemical Technology and the institution of the new degree of Bachelor of Technological Science (B.Sc., Technological). This decision is the joint response of the University and the Heriot-Watt College to the urgent national need for more trained technologists and the department of chemical technology will be housed in the College. The professor, who will occupy a University Chair, will also act as head of the department within the College.

In the first three years, students will concentrate on the basic sciences—physics, chemistry, mathematics—reserving the final year for the study of chemical technology, *i.e.*, the application of chemical techniques to design, construction, and operation of plant.

Notes of the Month

U.K. Crude Oil Production

During 1953, production from Anglo-Iranian oilfields centred round Eakring (Nottinghamshire) and Formby (Lancashire) totalled 54,600 tons.

Since 1935 these fields, which are the only commercial producing oilfields in the U.K., have yielded 802,000 tons of crude oil. The crude oil is refined at the Company's refinery at Pumpherston in Scotland.

Continental Refineries Throughput

Oil processed last year at the six continental refineries operated by the Anglo-Iranian Oil Company, Ltd. and its associates increased by over 500,000 tons. Provisional figures for 1953 show a total of 8,000,000 tons compared with 7,495,000 tons in 1952.

There are two refineries in France, two in Germany, and one each in Belgium and Italy; all six contributed to the increase. The highest throughput last year was at Lavera refinery near Marseilles—operated by Anglo-Iranian's French associate, Société Générale des Huiles de Pétrole BP—where 2,210,000 tons of oil were processed.

Crude Oil Productions

	January 1954
	Brl
Trinidad Petroleum Development Co. Ltd. . . .	282,418
Kern Oil Co. Ltd.:	
California	108,028
Trinidad	85,001
	Tons
Kuwait Oil Co. Ltd.	3,326,758
Iraq Petroleum Co. Ltd.—Kirkuk	2,253,782
Basrah Petroleum Co. Ltd.—Zubair	276,428
Mosul Petroleum Co. Ltd.—Ain Zalah and Butmah	107,102

ABCM Exhibition Policy

A decline of interest among exhibitors in the chemical section of the British Industries Fair at Olympia, has led to a decision by the Association of British Chemical Manufacturers not to exhibit at Olympia this year.

There is, however, to be an ABCM stand at the Birmingham section of the BIF, on which 20 leading chemical companies will have separate displays.

Two committees have been formed by the ABCM to consider the promotion of separate specialized exhibitions for the industry and to review what part should be taken in the BIF at Olympia or Birmingham.

The decision to exhibit at Birmingham springs from the idea that there may be a closer affinity between the chemical industry and those industries which habitually exhibit at Birmingham than there is with those which normally show at Olympia. This year's experiment at Birmingham will also enable the Association to assess the advantages of Birmingham as an exhibition centre.

French Exhibition and Conference

The third *Salon de la Chimie et des Matières Plastiques* is to take place at the Parc des Expositions, Porte de Versailles, Paris, from 3-12 December 1954.

Four complementary exhibitions are to be staged showing laboratory equipment, chemical products, chemical engineering plant, and various aspects of the plastics industry.

The third session of the Chemical Engineering Conference will take place at the same time as the exhibition. Lectures will be given on a number of problems encountered in modern factories, and international technical meetings, symposia, and discussions will also be held on subjects such as analysis and testing; electronics; industrial control and regulation; anti-corrosion, etc.

Exhibitors and visitors should apply to the Commissariat Général du IIIe Salon de la Chimie et des Matières Plastiques, 28 Rue Saint Dominique, Paris 7 ème.

New Esso Tanker

The new 26,500-ton tanker *Esso Canterbury* which was launched recently at Barrow-in-Furness is the third ship to be launched of six similar vessels ordered by the Esso Group from shipyards in this country.

The Esso Canterbury has a service speed of 16 knots and can carry a cargo of over 24,000 tons of crude oil. A feature of the vessel is the remarkably high rate of discharge, which is approximately 3000 tons per hour.

The launching ceremony was performed by Mrs Jenkins, wife

of William E. Jenkins, C.B.E., managing director of Esso Petroleum Company Limited.

Speaking at the launching, Leonard Sinclair, chairman and managing director of Esso Petroleum Company Ltd, said that his Company would continue to place its orders for new tankers with British shipbuilders provided, of course, that the cost and date of delivery were reasonably competitive.

Deep Drilling for Natural Gas

The D'Arcy Exploration Company, Anglo-Iranian's prospecting subsidiary, has begun drilling for natural gas at Cousland, near Dalkeith, Scotland. The venture is part of the Gas Council's five-year scheme. The presence of natural gas in this area is known as a result of borings made before the war, but further drilling is necessary to establish the extent of the reserve.

* * *

RECENT TECHNICAL MEETINGS

Accident Prevention

At the IP meeting on 17 February, T. T. MacLean spoke on accident prevention in industry and presented three films used by the Anglo-Iranian Oil Company to promote safe-working practices among their staff at Abadan. These films were apt and at times not without humour.

The chair was taken by H. S. Gibson, President of the Institute, and discussion after the paper was followed by a vote of thanks proposed by the chairman.

Refining Progress

A paper described by one of the audience as "a clear picture of the petroleum refining industry from its conception" was read to The Society of Engineers by C. R. Young, B.Sc., F.Inst. Pet., process superintendent at Fawley refinery, on 1 March. In the comparatively short time available, Mr Young gave a lucid and concise account of the chemistry of petroleum and on the refining side dealt with distillation, cracking, and chemical treatments.

Many questions were asked and ably answered following delivery of the paper and the author was obviously not expected to accede to a request to expound on the relative merits of certain petrol additives.

* * *

PETROLEUM TAXATION—DILEMMA OR CHALLENGE?

The Economics and Operations Group of the Institute are holding a meeting at 5.30 p.m. on 4 May to discuss various aspects of petroleum taxation. The problem of taxation will be dealt with under three heads:

(i) The national economy in the U.K.
(ii) Engine design.
(iii) Refinery operations.

The discussions will be held under the chairmanship of A. L. King of Shell-Mex and B.P. Ltd. who has himself made a special study of taxation. Mr King was the author of a paper on "The Effects of Taxation on the Consumption of Petroleum Products in the U.K." which he read at last year's Summer Meeting of the Institute at Buxton.

Meetings of the Group are restricted to Group members and their guests, but new members are always welcome. Application forms for membership may be obtained from the General Secretary.

* * *

SITUATION VACANT

Applications are invited by the **Vacuum Oil Company Limited** for the position of **ASSISTANT CHIEF CHEMIST** in their laboratory at Coryton Refinery, Essex. Applicants should have B.Sc., A.R.I.C., or equivalent qualifications and experience in a petroleum laboratory, preferably in a refinery. The work entails the supervision of an analytical testing section, control of refinery processes involved in the production of petroleum products and all the ancillary problems arising therefrom. Applications giving full details of qualifications and experience and quoting reference "A.C." should be addressed to the Industrial Relations Superintendent, Vacuum Oil Company Limited, Coryton, Essex.

Forthcoming Meetings

THE INSTITUTE

(At 26 Portland Place, London, W.1, 5.30 p.m.—tea 5 p.m.)

The Design and Manufacture of Welded Pressure Vessels. T. B. Webb, B.Sc., M.I.Mech.E., M.A.S.M.E. **14 April**

Rotary Drilling Rigs. C. T. Reichert **29 April**

Summer Meeting. The Rôle of Petroleum in Modern Transport. Llandudno. **12-15 May**

Medical Services in the Petroleum Industry **19 May**

IP FAWLEY BRANCH

(At Esso (Fawley) Recreation Club, Holbury, 7.30 p.m.)

Motor Racing. Captain George Eyston. **9 April**

IP LONDON BRANCH

(At 26 Portland Place, London, W.1, 6 p.m.—tea 5.30 p.m.)

Branch Forum. **18 May**

IP NORTHERN BRANCH

(At Engineers' Club, Albert Square, Manchester 2, 6.30 p.m.)

Automatic Instrumentation in the Petroleum Industry. **20 April**

IP SOUTH EASTERN BRANCH

(At King's Head Hotel, Rochester, 7.45 p.m.)

Refinery Electrification. F. N. Beaumont and G. A. McLennan. **4 May**

LECTURERS

The Petroleum Information Bureau of 29 New Bond Street, London, W.1., would be glad to hear from any retired members of the oil industry, with a flair for lecturing, who are willing to give talks on the petroleum industry to Rotary Clubs, etc., in the following counties:—Yorkshire, Essex, Surrey, Hants, Wilts, Somerset, Gloucester, Bucks, Shropshire, Stafford, Berks, Oxford, and North and South Wales.

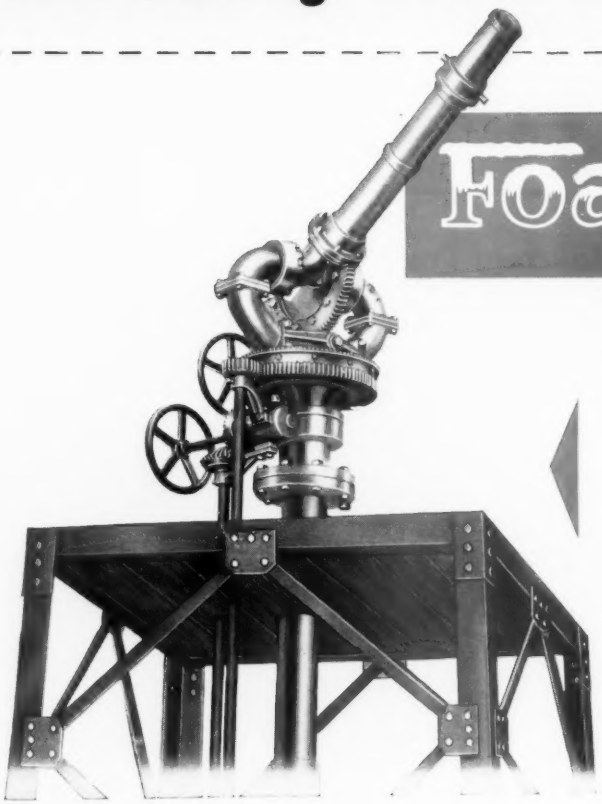
ASTM MASS SPECTROMETRY MEETING

The second Annual Meeting of committee E-14 on mass spectrometry is to be held by the American Society for Testing Materials during the week commencing 24 May. It is to take place at the Jung Hotel in New Orleans, Louisiana. Forty-six papers will be presented covering isotopic abundance determination, ionization potentials, solids analysis, high molecular weight analysis, and new mass spectrometer techniques and developments.

There will be two mass spectrometer clinics sponsored by instrument manufacturers and during the week there will be meetings of E-14 sub-committees.

Further details can be obtained from Mr William Priestley, Jr., Standard Oil Development Company, P.O. Box 121, Linden, New Jersey.

Oil Jetty Fire Protection



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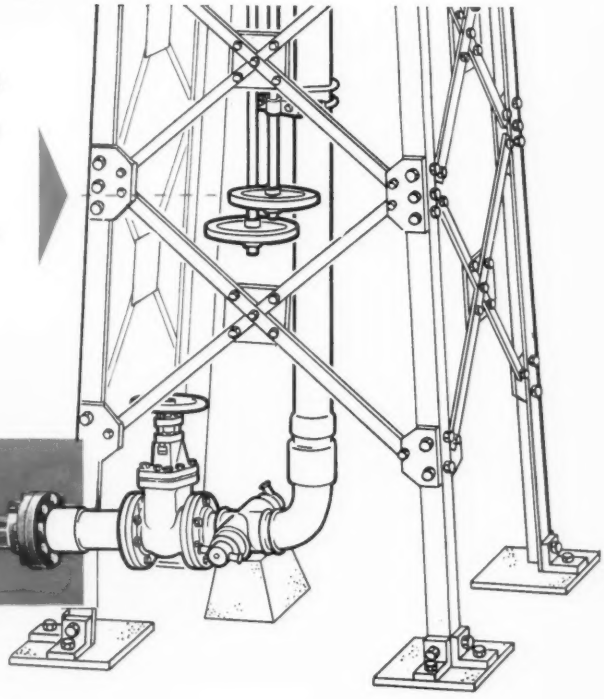

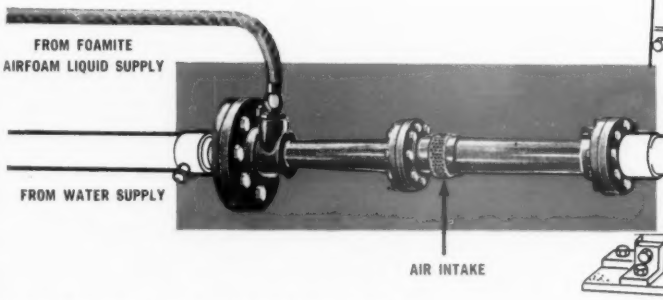

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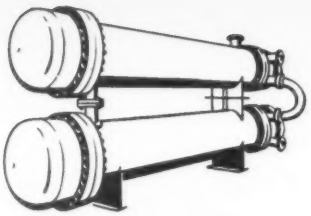

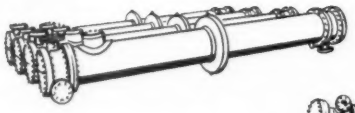

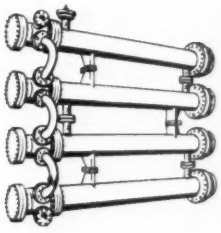

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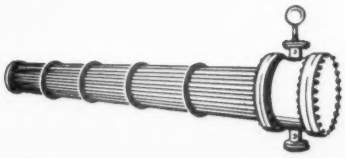

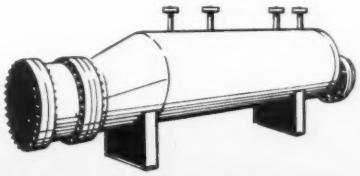

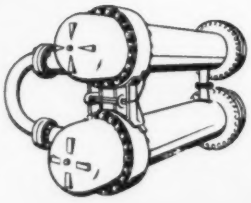

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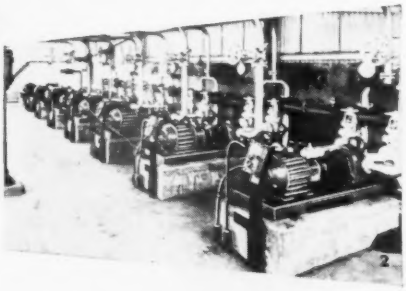

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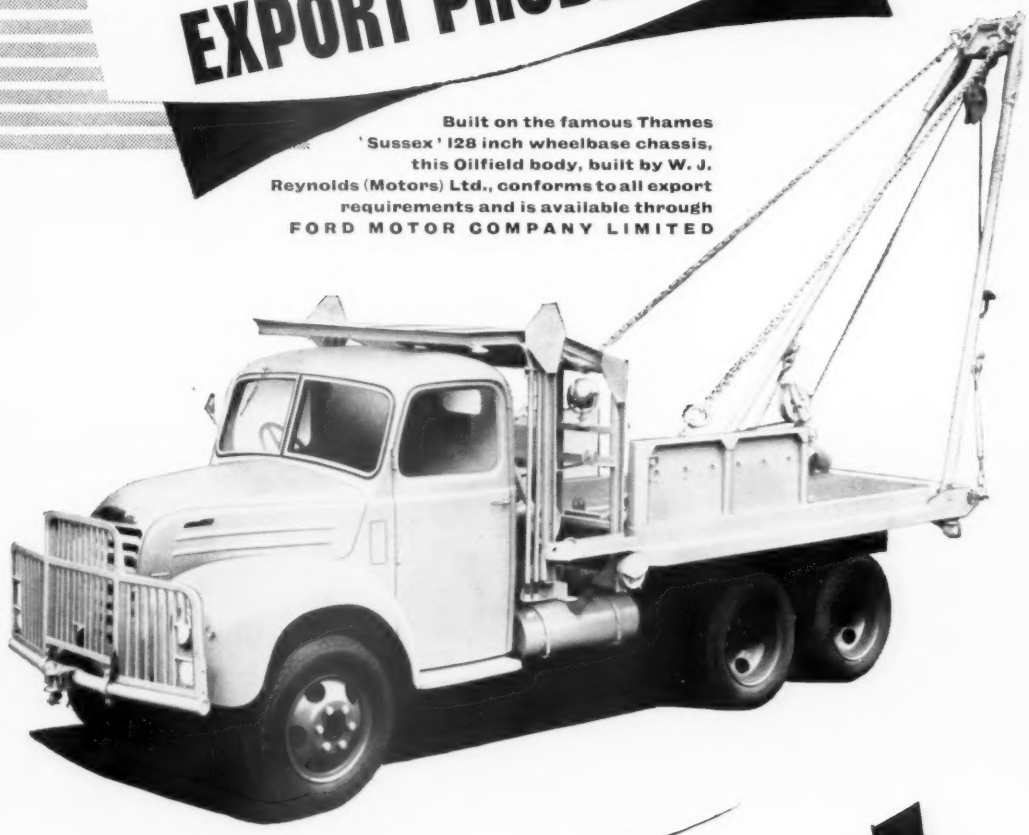

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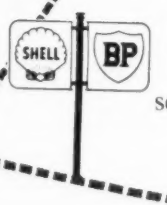

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Power for Uganda: Water for the fellahin

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For the Egyptian cultivator the dam in far off Uganda will finally secure regular water supplies by enabling surplus rainfall to be held back in Lake Victoria against exceptionally dry years. The importance of this can be gauged by the fact that the difference between copious and deficient Nile floods is of the order of two hundred million tons a day.

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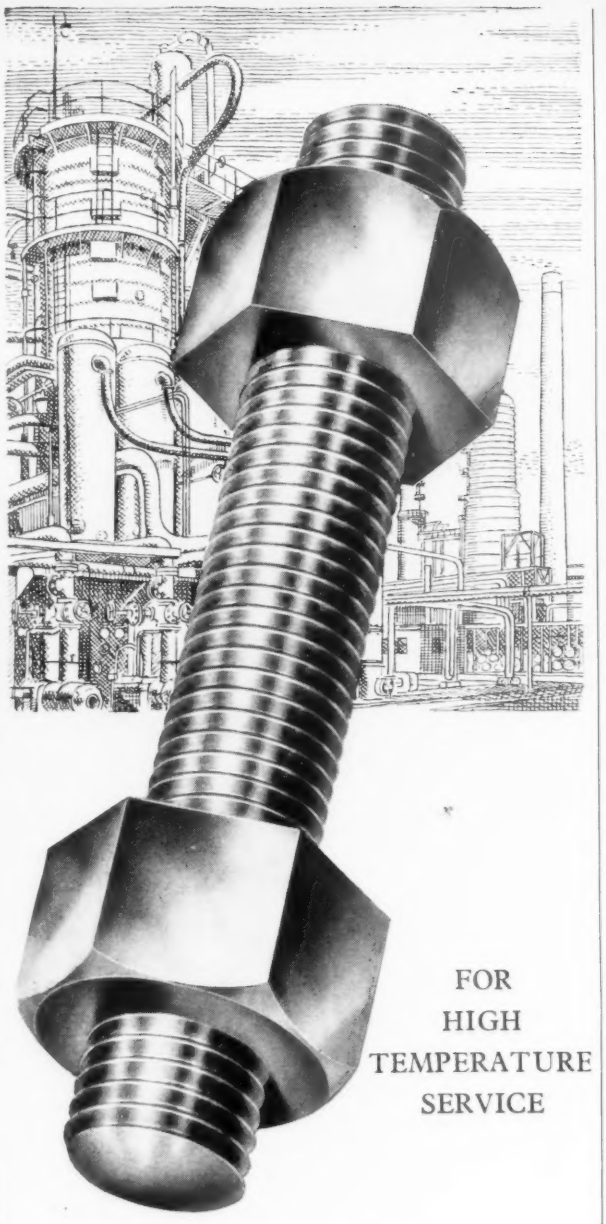

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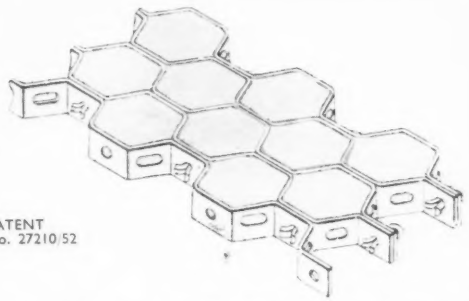

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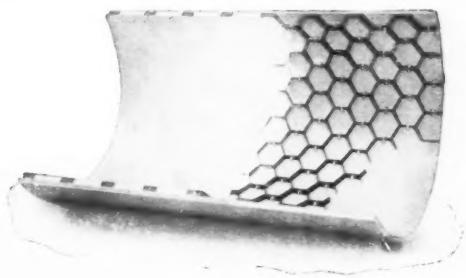

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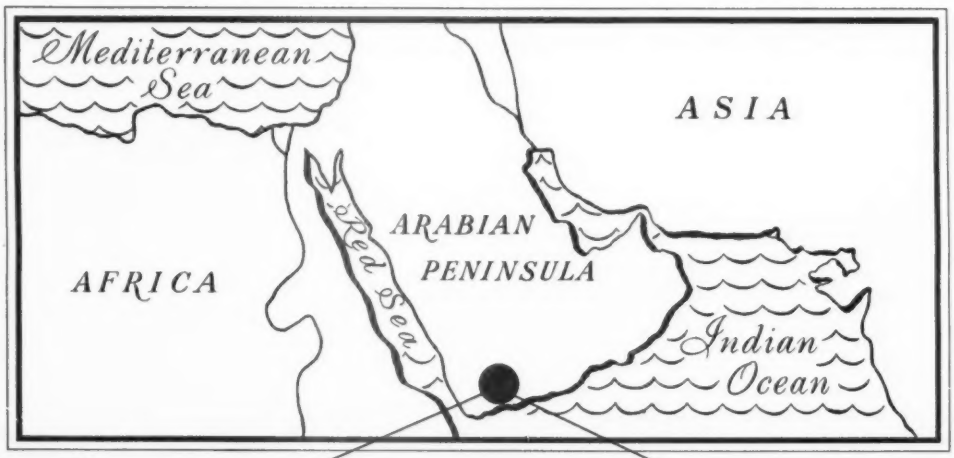

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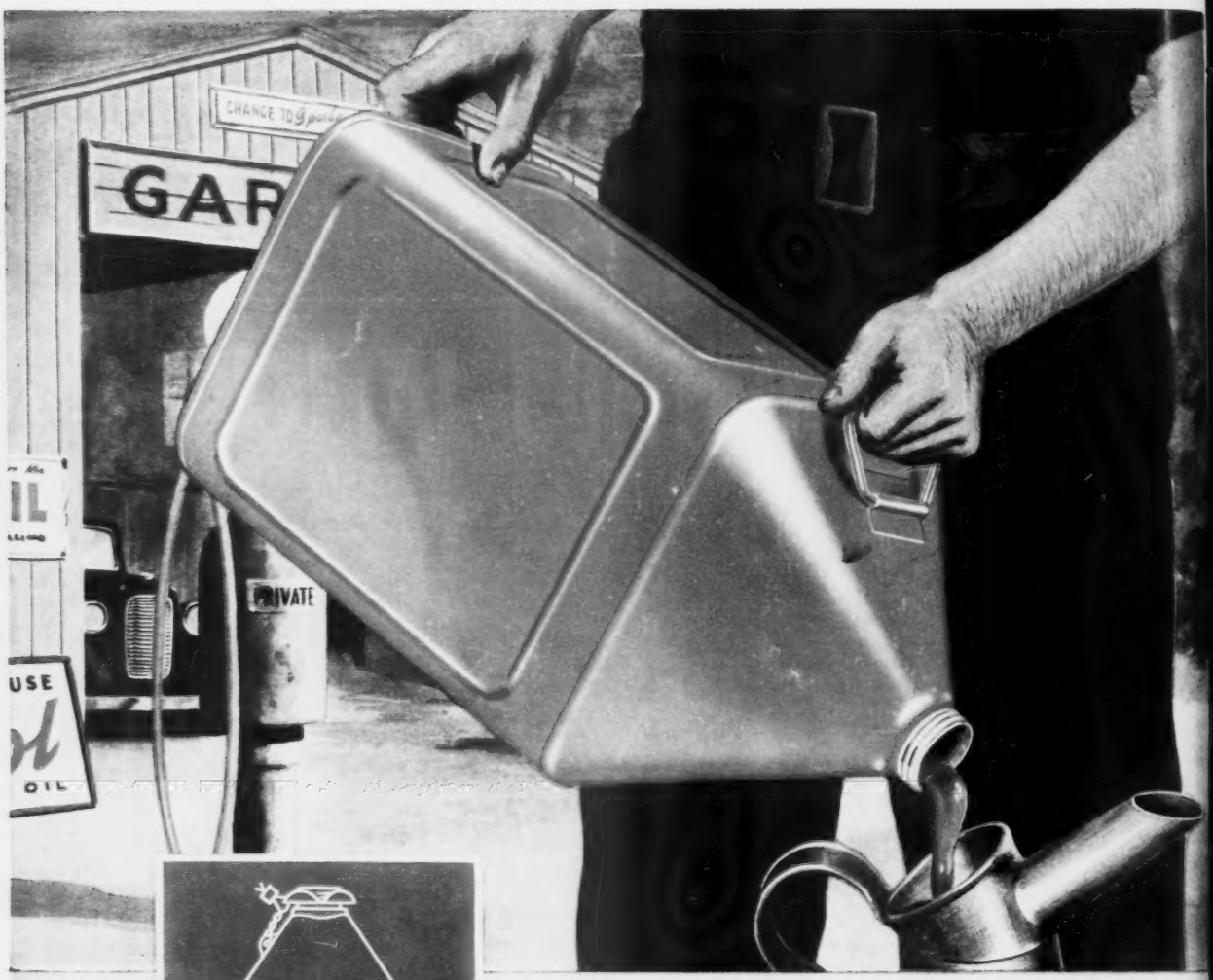

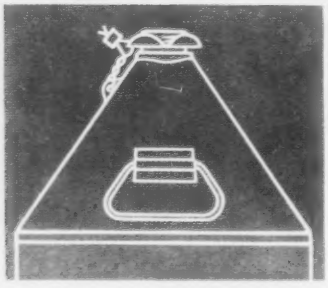

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